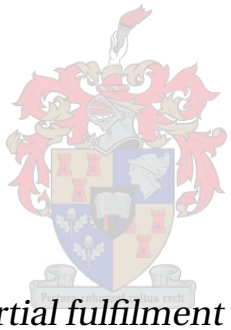
A study of performance-related injuries among BMus violin students in South Africa

by

Jenna O'Neill



Thesis presented in partial fulfilment of the requirements for the degree of Master of Music in the Faculty of Arts and Social Sciences at Stellenbosch University

Supervisor: Dr. H. S. Martens

April 2019

Declaration

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Date: April 2019

Abstract

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J. O'Neill

Department of Music,
University of Stellenbosch,
Private Bag X1, Matieland 7602, South Africa.

Thesis: MMus

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Musculoskeletal problems affect musicians internationally. When they occur as a result of playing an instrument, they are referred to as playing-related musculoskeletal disorders (PRMDs).

This study aims to examine the extent of PRMDs among Bachelor of Music (BMus) violinists in third and fourth year, as well as students who graduated in the year prior to the study. Fourteen violinists from various universities were given questionnaires. The first part of the questionnaire addresses issues regarding the prevalence and location of pain, severity, duration of symptoms, and treatment routes of PMRDs. The second part of the questionnaire enquires about the availability of resources by institutions and looks at the use of this information for prevention and help-seeking behaviour/ treatment.

The findings showed that 100% of participants experienced a playing-related problem in the last 12 months. Only 64.3% of students reported their institution offering classes on performing-arts health, however, the attendance for the classes was also low, at 67%, even though the majority of students stated that

performing-arts health courses were "very important".

The thesis is concluded with recommendations for institutions, learners, and teachers to try and reduce the rate and effect of PMRDs.

Uittreksel

'n Studie van speelverwante-beseerings onder BMus vioolstudente in Suid-Afrika

J. O'Neill

Departement Musiek,
Universiteit van Stellenbosch,
Privaatsak X1, Matieland 7602, Suid Afrika.

Tesis: MMus

April 2019

Muskuloskeletale probleme beïnvloed musikante wêreldwyd en wanneer dit manifesteer as gevolg van die bespeling van 'n instrument, word daarna verwys as speelverwante muskuloskeletale stoornis of sindroom (PRMDs).

Die doel van hierdie studie is om die omvang van PRMD te toets in derde - en vierde jaar BMus studente, asook studente wat gegradueer het in die jaar voordat met hierdie navorsing begin is. Vraelyste is gegee aan veertien violiste van verskillende universiteite. Die eerste deel van die vraelys spreek aangeleenthede aan wat verband hou met die voorkoms van die pyn, die felheid daarvan, die duur van die simptome en behandelingsopsies vir PRMD. Die tweede deel van die vraelys ondersoek die beskikbaarheid van bronne by instansies/universiteite, en ondersoek die gebruik van hierdie inligting vir die voorkoming en behandeling van studente wat om hulp vra.

Die bevindings bevestig dat 100% van die deelnemers 'n oefenverwante probleem in die laaste 12 maande ervaar het, waarvan 64,3% pyn ondervind het in die linkerskouer. 50% het bevestig dat die aard van die pyn gewissel het, maar

nooit heeltemal verdwyn het nie. Slegs 64,3% van die studente het aangedui dat hul instansie/universiteit klasse aanbied in musiekvoordrag-gesondheid. Alhoewel die bywoning van die klasse so laag as 67% was, het die meerderheid van studente saamgestem dat musiekvoordrag-gesondheidsklasse "baie belangrik" is.

Die navorsing sluit af met aanbevelings vir instansies/universiteite, studente en onderwysers om te poog om die voorkoms en gevolge van PMRD te verminder.

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Dedications

I would like to dedicate this thesis to all the young musicians who have been, or will be affected by a performance-related injury.

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Chapter 1

Introduction

In South Africa, little research has been done on performance-related injuries. Although the interest in music physiology is growing, further research is warranted. The few studies that do exist show that there is a high prevalence of injuries among South African musicians. A study by Barnes *et al.* (2011, 42) found that 84.4% of musicians in the Free State Symphony Orchestra experienced injuries related to the playing of their instruments. However, the literature on injuries in South Africa still remains quite generalised and non-instrument specific.

According to Rennie-Salonen and de Villiers (2016, 131):

> Research shows that tertiary level musicians' occupational health education is imperative and that in other countries there are specific programmes designed to teach learners occupational health.

Rennie-Salonen and de Villiers (2016, 131) point out that even though physical injuries are a large problem in tertiary education, not one South African university has a programme in place to educate teachers and learners on injuries. Injuries worsen at a university level due to the increased amount of practice time. Prolonged playing time combined with bad technique is a recipe for injury (Llobet and George, 2007).

With reference to help-seeking behaviours, a study by Barnes *et al.* (2011) showed 44.7% of participants "did nothing in response to the symptom. Only

34.2% of respondents indicated that they sought physiotherapy treatment, while 31.6% took medication to alleviate their symptoms and 31.6% reduced their playing hours".

According to Cornally and McCarthy (2011),

> The concept 'help-seeking behaviour' has gained popularity in recent years as an important vehicle for exploring and understanding patient delay and prompt action across a variety of health conditions...Help-seeking behaviour for a health problem can be defined as a problem focused, planned behaviour, involving interpersonal interaction with a selected health-care professional.

When referring to "help-seeking behaviour" in this thesis, the author is referring to the violinist's actions to seek treatment, whether from an educator or health professional, as well as the application of the information gained from the educators and health professionals.

1.1 Background

Studies show that there is a high rate of performance-related injuries among South African classical musicians (Thaele, 2016, 6). In two separate South African studies by Thaele (2016) and Barnes *et al.* (2011), over 80% of musicians in South Africa reported having performance-related injuries in the past year. How does this compare with the prevalence of such injuries internationally? In a study investigating the international prevalence of performance-related injuries by Zaza (1998, 1020), it was discovered that "prevalence ranged from 39% to 87% in adult musicians and from 34% to 62% in secondary school music students".

There is evidence that suggests the rate of performance-related injuries in South Africa are high compared to international standards (Barnes *et al.*, 2011). It is therefore important that one determines the root of the problem in South Africa; whether it be a lack of education, or a lack of applying the knowledge. According to Marxhausen (2017), many musicians believe "injuries are a normal

part of performance and find ways to mask the effects of a developing injury."

Injuries can have a detrimental impact on musicians, causing them not only physical pain, but also emotional health problems and social isolation (Guptill, 2011). Untreated injuries may also lead to a partial or complete inability to perform, posing a threat to musicians' livelihoods or an inability to complete their studies. Without proper intervention, these problems will not be solved. It is the aim of this research to identify the shortcomings in education on occupational health and to suggest possible strategies for reducing the impact of performance-related injuries.

Several health-related problems may arise from playing an instrument (Chesky *et al.*, 2006, 143), however, the focus of this thesis is on musculoskeletal problems associated with prolonged and incorrect practice and performance of the violin.

The organisation known as the Health Promotion in Schools of Music (HPSM) believes that education and hands-on programmes are the most effective ways of preventing performance-related injuries. To evaluate this statement in the South African context, one must establish what learners and teachers in South Africa already know. According to Rennie-Salonen and de Villiers (2016, 134) there is a very low awareness on health responsibilities, exercise, and occupational health education among South African musicians. Although HPSM (2009) believes that the root of the problem is education, it must be considered that awareness and knowledge do not necessarily result in behavioural changes or help-seeking behaviours[1].

1.1.1 International programmes

Internationally, there are numerous programmes established to address the occupational health problems faced by musicians, such as BAPAM, HPSM and

[1] It is suggested that a network of professional medical practitioners with an interest in musicians' injuries be created. The reason for this is that musicians often avoid medical professionals due to a fear that they will be told to stop playing or that the medical professional will not have the adequate knowledge to treat performance-related injuries (Stanhope *et al.*, 2014; Rennie-Salonen and de Villiers, 2016).

IFPAM. These programmes will be expanded on in this section. It is essential to examine programmes in place in other countries so that we establish what is offered internationally in terms of occupational health training for musicians. This will help develop an in-depth knowledge of the resources invested in occupational health training for musicians, as well as the structure and aims of programmes internationally.

Ideally, in examining international programmes, one should investigate what constitutes "international best practice", and draw lessons from this to establish similar programmes in South Africa. Below, a brief overview of select international programmes are discussed to acquaint the reader on what is offered globally (Ruch *et al.*, 2015).

1.1.1.1 Health Promotion in Schools of Music (HPSM)

The HPSM was established by the Performing-Arts Medicine Association (PAMA) in Texas in the United States (Chesky *et al.*, 2006). The HPSM's mission statement reads as follows:

> The primary goal of the Health Promotion in Schools of Music (HPSM) project is to assist schools of music to prevent occupational injuries associated with learning and performing music.

Using this as their goal, HPSM collaborates with medical professionals and assists musicians with performance-related injuries (HPSM, 2009).

Below, the declarations of HPSM are stated:

- Performance injuries are preventable. A holistic approach that encourages wellness and personal responsibility is necessary for prevention. Schools of music should focus on prevention education in addition to supporting efforts directed at treating diseases once they have occurred.

- Schools of music do influence student behaviours through factors such as collective values, beliefs, and actions. These factors need to be considered and modified as crucial first steps toward reducing the rate and severity of performance injuries. A health promotion framework offers a common philosophical and practical basis for such efforts and would allow for effective and sustainable prevention-oriented educational efforts.

From this statement, one can see that the HPSM wholly believes that injuries are preventable and treatable through the application of techniques. Recommendations given by the HPSM are as follows:

1. Music institutions should be proactive in providing programmes to students. According to HPSM, the active involvement of interdisciplinary professionals (e.g., physiotherapists and doctors) will most likely allow for a higher success rate in the music department.

2. All institutions offering music majors should provide an occupational health course. The reason for this being that prevention of injury is easier than treating an injury.

3. There should be an increased emphasis on educating students on hearing loss in ensemble settings.

4. "Music students need to know when and where to go for help. Directors of student health resources, including student health centres, speech and hearing centres, mental health counselling centres, and others, need to know that music students may have unique and challenging health situations and that there are resources and performing-arts medicine experts willing to help if needed" (HPSM, 2009).

1.1.1.2 British Association for performing-arts Medicine (BAPAM)

The British Association for Performing-Arts Medicine (BAPAM) is a charity organisation set up to assist performing artists with avoiding and overcoming

injuries. The BAPAM offers free clinics and resources on injury prevention and cure. It also provides a database of programmes, medical professionals, and research related to injury prevention and cure. Below is a list of BAPAM's services:

- Free clinics
- Resources
- Directory of practitioners
- Healthy performance training
- Events
- Training programmes
- Research

1.1.1.3 The International Foundation for Performing-Arts Medicine (IFPAM)

The International Foundation for Performing-Arts Medicine (IFPAM) was established in 1992 to help performing artists and students avoid injuries, as well as distribute information. The IFPAM has become one of the leading resources for information worldwide. The organisation encourages interested parties to contact them for further information on injury prevention and treatment.

Within the organisation, there is a working team of medical professionals, as well as artistic advisors who work together to address issues faced by performers in terms of occupational health. The IFPAM also has a working relationship with the BAPAM and the German Society for Music Physiology and Musician's Medicine.

1.1.1.4 The German Society for Music Physiology and Musician's Medicine (DGfMM)

The German Society for Music Physiology and Musician's Medicine (Deutsche Gesellschaft für Musikphysiologie und Musikermedizin) was founded in 1994 in Munich. Unlike the HPSM, the DGfMM's focus is musicians' injuries rather than performing-arts injuries in general (such as dance injuries) (Blum, 1999, 154). The society's primary aims are the:

> Enhancement and promotion of science, research, and teaching in the field of physiology and pathophysiology of music making, pathology and clinical medicine in somatic, and psychosomatic disorders of musicians. This includes the development of preventive, diagnostic, and therapeutic protocols (Blum, 1999, 154).

The DGfMM has their own website[2], with information on upcoming or past symposiums, news, and events.

There is a section on their missions, similar to the HPSM's website. The missions are as follows:

- Promoting science, research, and teaching concerning the physiology and pathophysiology of music performance, as well as pathological and clinical aspects of physical and psychological diseases in musicians.
- Improving preventive, diagnostic, and therapeutic measures.
- Emphasising an interdisciplinary cooperation of those who participate in the training and professional company of musicians, like instrumental and vocal teachers, occupational scientists, manufacturers of musical instruments, physicians, dentists, psychotherapists, physical therapists, Alexander Technique teachers, Feldenkrais method teachers, and mediators of other, similar therapies.

[2] http://www.dgfmm.org/our_mission.html

- Extending the close cooperation with performing-arts centres, professional orchestras, musical trainee-institutions (music schools, conservatories, music universities), as well as other performing artists and their institutions.
- Scientific conferences and symposia on a regular basis.
- Publication of the practice-orientated scientific journal 'Musikphysiologie und Musikermedizin', serving as the association's main academic output.
- Commitment to scientific-oriented public relations.

The DGfMM website provides resources for musicians, medical professionals, and other interested parties. The DGfMM has its own journal, as well as a journal database from which members can request and upload articles. It also provides links to external resource databases and websites.

In 1999, when Blum (1999) wrote the article on the German Society for Music Physiology and Musician's Medicine, there was an increasing number of physicians having contractual arrangements with universities. Most of these physicians were employed part time, however, currently there are several universities were there is full time employment of physicians.

Some institutions, such as the Music College Hannover (Musikschule Hannover), are connected with the Institute of Music Physiology and Musicians' Medicine. The Institute of Music Physiology and Musicians' Medicine is equipped with high-end technology specifically used to research and treat neurological disorders and neurophysiologic problems in musicians (Blum, 1999, 154).

Currently, on the DGfMM (DGfMM website, 2017) website are are multiple lists of cooperating institutions. It is interesting to note how quickly (a period of 18 years) DGfMM managed to create such a great following and support[3][4][5][6].

[3] http://www.dgfmm.org/music_universities_conservatives.html
[4] http://www.dgfmm.org/music_schools.html
[5] http://www.dgfmm.org/further_music_cooperation.html
[6] http://www.dgfmm.org/clinical_research.html

1.1.1.5 Other noteworthy programmes

There are many other programmes worldwide that help performers, musicians, and students. However, it is not possible to mention them all. Further programmes mentioned on the DGfMM website[7] are:

- Arts Medicine Aoteareo (Neuseeland): www.converge.org.nz/amanz
- Dutch Performing-Arts Medicine Association: www.nvdmg.org
- Médecine des Arts - Frankreich : www.arts-medicine.com
- Österreichische Gesellschaft für Musik und Medizin: www.oegfmm.at
- Performing-Arts Medicine Association, USA: www.artsmed.org
- Schweizerische Gesellschaft für Musik-Medizin: www.musik-medizin.ch

[7] http://www.dgfmm.org/links_english.html

1.1.2 Programmes in South Africa

Devroop (2014, 47) states that in South Africa there is a "tremendous lack of knowledge" regarding occupational health for musicians, particularly in comparison to international standards. However, there is a relatively good knowledge of Alexander Technique among students and lecturers (Thaele, 2016, 4). Although 80% of participants from the University of Cape Town knew about Alexander Technique, only 4.6% used it regularly (Thaele, 2016, 168).

1.1.3 Research question

In this mixed methods, quantitative study, an attempt will be made to answer the following research question:

> What is the extent of knowledge of performance-related injuries among BMus violin students in South Africa, and to what extent is this knowledge translated into prevention and help-seeking behaviour/treatment?

The question set out to inform the readers that this study is not only going to be looking at data on injuries, but also on help-seeking behaviours. To help address the questions above, the following questions will be asked. These questions will be aimed at third and fourth year BMus violin students, as well as students graduating in the year prior to the study:

1. What is extent of performance-related injuries among the sample group?
    (a) Have they personally experienced any injuries (location, severity, and duration)?
    (b) Did they seek treatment and if so, who did they go to for treatment; what treatment strategies have they implemented themselves; and to what extent did the treatment help?

2. What do they feel the short coming are in South African Universities.

3. What measures can be put in place in universities in South Africa to improve performance health?

4. What form of instruction do current BMus students receive with regard to performance-related injuries and the prevention of such injuries?

5. How often do they apply the information that they have been given in daily practice?

In answering these questions, music students, educators, and institutions will be able to properly assess the strategies and tools that can be used to minimise the effect of performance-related injuries.

1.2 Literature review

The literature review covers various books, articles, and web pages. The value of the individual sources for this thesis will be evaluated in this chapter.

There is rich literature on performance-related injuries among musicians. For the purposes of this thesis, the literature has been sorted into two main categories. The first category is literature on South Africa specifically and the second is literature on physiology (from international literature).

1.2.1 South African literature

Although there is not a large amount of literature on South African performance-related injuries, the studies and articles written are comprehensive. It is important to look at the South African literature so that parallels can be made between South African and international statistics.

Injury profile of musicians in the Bloemfontein based Free State Symphony Orchestra: A short report (Barnes *et al.*, 2011)

This article provides some very important information regarding performance-related injuries in South Africa. There is little literature otherwise on South Africa in this respect, making this article a crucial case study for the purposes of this thesis. The authors of this article are physiotherapists and explore the potential benefits of physiotherapy for musicians suffering from performance-related injuries. There is also a quantitative element to the study, which will be contrasted to the findings of this thesis.

This study had 45 participants from the Free State Symphony Orchestra. Of the participants, 84.4% reported having injuries they perceive to be related to the playing their instrument. A further 70.3% reported playing without adequate rest. Moreover, 62.3 % admitted to persisting in playing after experiencing symptoms of performance-related injuries. Only 34.2% of the participants who had symptoms they perceived to be from performing sought physiotherapy, while as little as 31.6% reduced their playing hours.

Another issue highlighted by this study is the mentality prevalent among musicians that the "show must go on" (Barnes *et al.*, 2011, 2), and that pain is a normal part of playing an instrument (Barnes *et al.*, 2011, 3). Musicians find ways to conceal their pain and delay seeking treatment. Consequently, performance-related injuries become worse and more difficult to treat.

In addition to postural problems and long playing hours, physical weakness is a factor contributing to injuries (Barnes *et al.*, 2011, 3). It is suggested that the strengthening of muscles is important to support the body. The article suggests the use of the Alexander Technique[8] as a means to build and retain core muscle strength, and to promote the physical stability of musicians.

The results of the study reveals that South African musicians experience a relatively high rate of performance-related injuries.

[8]Alexander Technique (AT) a psychophysical method that helps to release unnecessary muscle tension and re-educates non-beneficial movement patterns through intentional inhibition of unwanted habitual behaviours (Klein *et al.*, 2014).

Prevalence of musculoskeletal disorders among instrumental musicians at a centre for performing-arts in South Africa (Ajidahun and Phillips, 2013)

This source marks the beginning of research on performing-arts health in South Africa (and Africa). Ajidahun and Phillips (2013, 96) state that at the time of the study in 2013, "from this discipline, little or nothing is recorded from Africa". The purpose of this study was to determine the prevalence and type of musculoskeletal disorders of musicians in South Africa.

The sample was 20 musicians from the centre of performing-arts in the Western Cape (South Africa). Participants were students and teachers with ages ranging from 10 to 50 years of age, with the average age being 19.7 years. The large generational spread of data in the study by Ajidahun and Phillips (2013) allowed for many variables to influence the data that may not be directly related to this thesis.

The Nordic Musculoskeletal Questionnaire[9] (used in this thesis) was used to determine the prevalence and distribution of pain in the participants. Ajidahun and Phillips (2013) found that 14 of the 17 respondents who answered this question reported a musculoskeletal disorder in the past 12 months.

The upper extremity was the highest reported location of pain with 'tightening and soreness'. Ajidahun and Phillips (2013) state that half of the participants were violinists, but they do not expand on the rate of injuries in different instrument groups. Although it is interesting to know the demographics (such as age and gender), the lack of comparison between the demographics and pain leaves one to question the point of knowing the demographics.

Three years later, Ajidahun and Phillips (2013) published a more comprehensive study in which new data and relevant comparisons take place.

[9]The Nordic Musculoskeletal Questionnaire (NMQ) was developed from a project funded by the Nordic Council of Ministers. The aim was to develop a standardised questionnaire comparing complaints regarding the lower back, neck and shoulders. This information will be used in epidemiological studies (Crawford, 2007, 300).

Upper extremity disability among string instrumentalists: Use of the Quick DASH and the NDI (Ajidahun *et al.*, 2016)

This article, which was written in September 2016 by South Africans based at the University of Witwaterstrand, addresses musicians' injuries from a medical perspective. The aim of the study conducted for this article was to establish the rate of disability among string instrumentalists. The method of Quick DASH and NDI used in their study will be used for the questionnaire in this thesis[10].

Although several risk factors are identified in this article, the most important risk factor found, that is relevant to this thesis, is that string instrumentalists experience the most musculoskeletal problems (Ajidahun *et al.*, 2016, 2). There are interesting statistics in this article relating to risk factors that will be included in this thesis, however, the importance of this article for the literature review lies in the data collection method (DASH). The article points out findings on injuries discovered through the DASH method.

Risk factors for musculoskeletal injury and disability include posture, repetitive movement, and socio-demographic factors like age and gender (Davies and Mangion, 2002). It was found that instrumentalists that had to turn the neck to hold the instrument (e.g., violin or viola), experienced more neck problems compared to other instrumentalists. It was also discovered that women experienced more injuries percentage-wise compared to men (Ajidahun *et al.*, 2016, 7).

One interesting correlation by Davies and Mangion (2002, 161) was that musicians who had been playing an instrument for more years had less performance-related injuries. This finding however should be viewed in context. Zaza and Muszynski (1998) and Thaele (2016) point out that this data can be skewed by the fact that people with playing-related injuries may stop playing because of the injury, leading to fewer years had on the instrument, whereas people not experiencing problems will carry on playing for many years.

[10]Quick DASH (Disability of the Arms, Shoulder, and Hands) and NDI are both tools used as questionnaires (quantitative questionnaires). One can find the Quick DASH on their website (http://www.dash.iwh.on.ca) (Dash website, 2016). On the questionnaire there is an optional section for sport and performing-arts. This will be used as a basis for this studies questionnaire.

Results of this study show a huge problem in South Africa (Ajidahun *et al.*, 2016):

> Musculoskeletal problems were reported by 35 (35.7%) of the respondents (in the last seven days) and 56.6% reported symptoms of musculoskeletal problems over the last year. Musculoskeletal problems were mainly reported in the lower back (50.5%), upper back (49.5%), neck (46.5%), and left shoulder (44.4%). Problems were reported in four or more body regions in the upper extremity and trunk by 39 (39.4%) of the string instrumentalists.

These statistics are shown to be linked to disability, causing the musicians' problems in everyday activities, such as house work, lifting grocery bags, and opening jars (Ajidahun *et al.*, 2016, 8). Studies show that musicians were usually affected in more than one area of the body.

In conclusion, this article states that:

> An understanding of the causative factors could be important in proffering preventive measures to reduce musculoskeletal problems associated with playing a string instrument and prevent eventual activity limitation and participation restriction as it pertains to activities of daily living (Ajidahun *et al.*, 2016, 8).

The prevalence of playing-related musculoskeletal disorders in selected Western classical music students at the South African College of Music, University of Cape Town (Thaele, 2016)

This is a very recent study of playing-related musculoskeletal disorders in South Africa. In addition to looking at the prevalence of injuries, Thaele (2016) looks at the different types of techniques used to treat and prevent injuries, and

the number of people who know about these prevention and treatment strategies. The treatment and prevention of injuries is similar to what will be looked at in this thesis.

Unlike the study by Ajidahun *et al.* (2016), prevalence of injuries is much higher in the study by Thaele (2016). Thaele (2016) states that 82.1% of participants had experienced injuries in the past year whereas Ajidahun *et al.* (2016) found a 56.6% prevalence.

Thaele (2016, 79) also states that third year students were at higher risk for injuries. One of the most important findings for use in this thesis is that:

> Although over half (51.7%) of the affected respondents had consulted a health professional, respondents tended to stay away from medical doctors and opt for more therapeutic approaches. Treatment strategies revealed a large amount of self-reliance rather than expert recommendations (Thaele, 2016, 79).

Considering that musicians prefer to be self-reliant when treating an injury (Thaele, 2016, 79), it would be helpful to properly educate musicians so that they can help themselves where possible. Thaele (2016, 80) states that it would be interesting to see what statistics look like among other universities in South Africa. This study will follow on from Thaele's research by focusing more on the problems violin students face as opposed to all instrumentalists.

Performing-Arts Medicine: A research model for South Africa (Devroop, 2014)

This source proved to be one of the most important for this thesis. Devroop (2014) discusses the lack of research and the lack of a clinical setting for research on performance-related injuries in South Africa. Although this article has wonderful pointers, it is almost impossible to follow these guidelines due to limited time and resources.

Devroop (2014) covers some general literature to form a basis for his article. He discusses one of the first ever large scale studies on performance injuries by Fishbein *et al.* (1988) with participants from the international conference of symphony and orchestral musicians (ICSOM). From this study (Fishbein *et al.*, 1988), it was deduced that 76% of orchestral musicians had performance-related injuries that affected their playing.

A very important review of the health promotion in schools of music conference (HPSM, 2009) in Devroop (2014, 49)) recommends that:

> All university music schools provide educational coursework on the health and safety, including performance-related medical problems of musicians.

After reviewing international literature, Devroop (2014) looks at what is happening in South Africa with regard to related studies, literature, and programmes. When this article was written in 2014, Devroop (2014, 51) states that there were no studies conducted on South African musicians.

Devroop (2014, 51) suggests that research done in South Africa should follow the same general model/process as that of international research. He discusses the following research points:

- Research teams: Interdisciplinary collaboration is necessary when working with performance-related problems. A team should be made up of the relevant professionals to properly perform research. These teams may include musicians, medical practitioners, physiotherapists, etc.
- Prevalence rates: Quantitative research needs to be done to find the baseline injury rate in South Africa. When a good baseline rate is established, other data can be compared to it.
- Risk factors: Being able to identify predisposing factors is an important part of research. There are two reasons why risk factors must be identified: firstly, so that data collected and studies conducted can be relevant

and correct (e.g., if string players have a very high injury rate, it may skew data on general injuries in musicians); secondly, so that we can take these factors and try find solutions to the problems.

- Education: Devroop (2014, 53) states that "short of an aggressive and sustained education campaign, the medical problems of performing artists will continue to permeate throughout our profession".
- Priority should also be placed on presenting researchers a platform to present their findings.

Devroop (2014, 54) states that South Africa should embrace this new field of study; although the humanities usually uses qualitative studies, more quantitative studies should be used because they allow for comparison as one can easily identify risk factors from numbers.

1.2.2 Literature on physiology

This section covers the literature review on performance-related injuries. Several international books and articles will be reviewed.

The musician's hand (Winspur and Parry, 1998)

This book provides very important and relevant information for this thesis by providing a broad overview of problems associated with music performance. Included in these conditions are carpal tunnel syndrome, nerve compression syndrome, thoracic outlet syndrome, and many others. These conditions will be used as a basis for Chapter 2 on *Common musculoskeletal problems with musicians*. This book is also of particular relevance due to the fact that it singles out particular risk factors for spesific instruments.

Winspur and Parry (1998) cover risk factors, prevention methods, conservative treatment, and surgery options, and are well versed on the fears of musicians when it comes to treatment. As well as looking at the physiological problems

with musicians, Winspur and Parry (1998) delve into some psychological problems that may present as injuries but with no physical cause.

An important point that Winspur and Parry (1998, xi) note, which other literature does not include, is the awkward seating position in the orchestral setting for violinists. A good idea for further studies would be to ask if seating positions in orchestra and a restricted space in orchestras (as is the case in many performance settings) is a risk factor.

Winspur is a practising hand surgeon in the UK specialising in musician injuries. Along with being a surgeon, he is also a trustee of the British Association for Performing-Arts Medicine (BAPAM), which is discussed under *international programmes* in Chapter 1 (Healthcare UK, 2017).

Parry, the co-author, was a rheumatologist specialising in upper limb problems of performance musicians. In 1975 he started working with the National Health Service (NHS) (Telegraph News, 2015). Both the authors are very highly regarded in their fields.

Strength or endurance training for undergraduate music majors at a university? (Ackermann *et al.*, 2002)

This article provides relevant results for use in this thesis. While Winspur and Parry (1998) looked at general disorders, Ackermann *et al.* (2002) look at the correlation between exercise (namely strength versus endurance training) and injury/pain rates in musicians.

The study was conducted on university students of all instrument groups. The first six weeks of the study was used as the control period, in order to find out the prevalence of pain during practising (Ackermann *et al.*, 2002, 36). For the second six-week period, participants were split into two groups: one for strength training and the other for endurance training.

Training was done on a biweekly basis for 45 minutes. For the strength training, participants were allocated weights that could only be lifted 6-8 times before

fatigue. Participants in the endurance category were given weights that would allow for 25-30 repetitions (Ackermann *et al.*, 2002, 35).

At the end of the six weeks, a test and a questionnaire were given. Participants from the 'endurance' category scored substantially higher than those in the strength group (Ackermann *et al.*, 2002, 37-38). The rate of performance-related pain while playing the instrument was substantially lower in the endurance group. The 'strength' group however did report less pain when playing their instruments[11].

This article presents very interesting and relevant information for this thesis as it clearly shows a way to prevent injuries. The exercises used presented positive results in such a short period of time (six weeks). Implementation of these techniques used over a longer period of time could create considerable results. Considering the statistics in South Africa around musicians with injuries, there is definitely a need for better prevention.

Another article by Ackermann and Adams (2003) is **Physical characteristics and pain patterns of skilled violinists**. This article looks at physical characteristics in order to establish what predisposes violinists to injuries. Ackermann and Adams (2003) also look at physical characteristics that form in violinists after years of playing. One interesting statistic is that violinists with shorter arms presented a higher rate of injury, however, with the correct set-up and hold of the violin, injuries are minimal. This study showed that the presence of shorter limbs does contribute to pain in the right arm of violinists. The left arm showed increased flexibility compared to the right arm particularly in participants with shorter arms. This shows the adaptation of the left arm to the demands of violin playing. Ackermann and Adams (2003, 70) conclude that teachers should take this information into consideration when moving a young learner to a larger size instrument, as an oversized instrument can create physiological problems for learners.

[11] Endurance refers to the ability to perform a specific action for a prolonged period, whereas strength refers to the ability to exert a force.

Injury prevention: What music teachers can do (Guptill and Zaza, 2010)

This article gives a good indication of what can be done from the educators' side to help with injury prevention. Often it is the teacher who has the power to change a technique or correct a problem, and it should also be the teachers responsibility to make sure that the learner is executing the correct technique, so as to avoid injury.

The effects of stretching exercises during rehearsals on string students' self-reported perceptions of discomfort (Cooper *et al.*, 2012)

This source looks at the positive effects of stretching. The study looked at the difference between perceived pain in a treatment group compared to a control group. Students from the treatment group were instructed to perform a set of very simple stretches at ten-minute intervals during a rehearsal. These stretches included wrist rotations, deltoid stretches, and neck rolls (Figure 1.1).

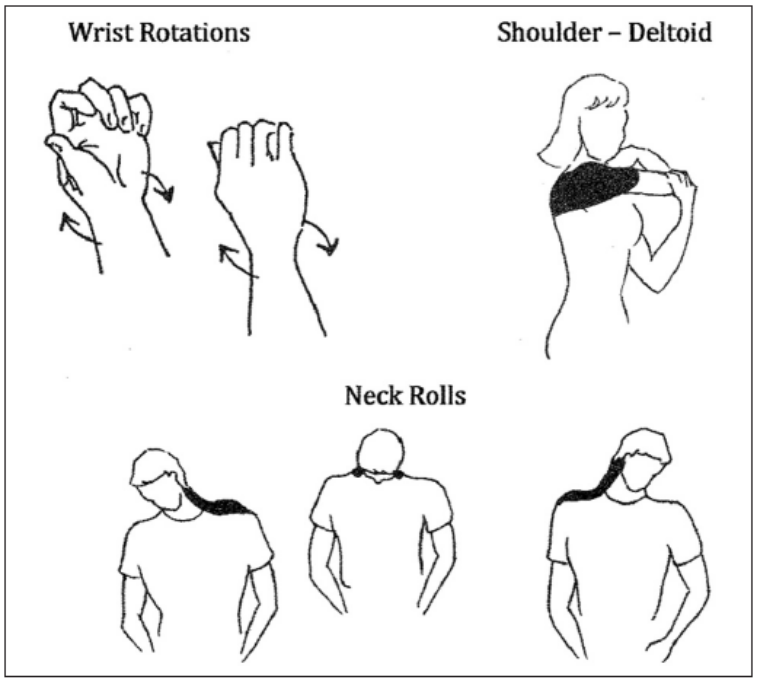


Figure 1.1: Diagram of stretches (Winberg and Salus (1990) in Cooper *et al.* (2012))

At the end of the rehearsal, students from the treatment group reported lower levels of pain than at the beginning of the rehearsal. Students in the control group reported significantly higher pain at the end of the rehearsal compared to the beginning of the rehearsal. Cooper *et al.* (2012) conclude by stating that educators have a very importenat role in instilling habits in learners, such as stretching. The educator also must make a habit themselves of permitting students to speak about their own pain or discomfort, and address it.

Motor activity as a way of preventing musculoskeletal problems in string musicians (Wilke, 2011)

In this source, Wilke (2011) discusses ways of injury prevention, as well as concerns of musicians. Being a musician takes a huge amount of effort mentally and physically. "Normal medical care"[12] (Wilke, 2011, 24) has not been able to keep up with the growing demand for medical intervention for musicians in the past decade.

Although string instrumentalists show a higher prevalence of injuries compared to other instrumentalists, only two thirds of string players consulted medical professionals. Another statistic presented is that out of those two thirds, only one third received a proper medical diagnosis, with the other third being classified as a general 'over-use injury'.

Three problems are presented in these statements: firstly, it shows that musicians often do not turn to medical professionals for help; secondly, the understanding of performance-related injuries is so low that many musicians do not get a diagnosis; and lastly, the prevalence is very high, indicating that prevention methods are not in place. The article then goes on to discuss prevention methods through strengthening, as well as mobility. Different types of exercises are given alongside their advantages, disadvantages, and notes on the exercises. Wilke (2011) also notes that musicians who partake in sport show less injuries than those who do none.

[12]This refers to medical professionals who are not knowledgeable on performance-related injuries.

In conclusion, a preventative approach to injuries should be taken, with the musicians working with a therapist to design a training programme specific to the musician (i.e., upper limb strengthening in violinists and lower back support for sitting musicians). Another prevention method mentioned is for correct technique to be taught to a learner from the start.

An occupational study of physical playing-related injuries in college music students (Guptill *et al.*, 2000)

This source forms a basis for many of the comparisons in Chapter 4 (*Findings and discussion*). This article looks at the rate of injuries, which health professionals were consulted by musicians with performing-related problems, as well as the satisfaction with treatment. It was found that 87.7% of participants had experienced playing-related injuries in their lives, with 44% of students consulting health professionals. Just over half of the participants who consulted with health professionals continued with treatment from the health professionals.

Guptill *et al.* (2000) found that of the students who continued with treatment, 86.9% were satisfied with the treatment they received. It was also concluded that participants found it important for the health professional to have musical knowledge. Findings in the study showed that upper strings had the highest rate of reported problems (at 100%), with all other instrument groups showing lower rates of injuries. Demographic information such as gender was also compared to injury rates, and Guptill *et al.* (2000) found that there was no significant difference between performance-related injuries in females and males.

A comparative study on the prevalence of musculoskeletal complaints among musicians and non-musicians (Kok *et al.*, 2013)

This article compares pain and injuries in music students to medical students. The assumption in this study is that medical students represent the general population who are not musicians. Kok *et al.* (2013) found that there were only two studies done comparing musicians to non-musicians and the results from the two studies were contrasting. This study by Kok *et al.* (2013) comprised

of 494 medical students and 83 music students.

Participants were asked to specify their age, gender, study year, main instrument, practice hours, and other information. These questions were used to create the general and demographic section of the questionnaire used for this thesis. The next section of Kok's (2013) study formed a basis for the question of prevalence of injuries in this thesis.

Results showed that 89.2% of music students and 77.9% of medical students had experienced musculoskeletal pain in the past 12 months, and 62.7% of music students and 42% of medical students were experiencing pain at the time of the study. with regard to specific body regions, music students showed a higher prevalence of pain in the upper body while medical students had more pain in the lower half of the body (hips and knees; ankles and feet).

Contrary to the study by Guptill *et al.* (2000), Kok *et al.* (2013) found that bowed string instrumentalists did not experience the highest rates of pain, although Kok *et al.* (2013) does not make a distinction between upper and lower string groups.

1.2.3 Conceptual framework

This thesis will draw on the work of Thaele (2016) and Devroop (2014), who emphasise the need for a better understanding of experiences amongst different universities in South Africa. Finally, the extent and influence of current education and the importance of raising awareness in South Africa will be explored. This will be addressed through asking:

1. What is the extent of performance-related injuries among BMus violinists at South African universities?
2. What form of instruction do current BMus students specialising in the violin receive with regard to performance-related injuries and the prevention of such injuries?

3. What is the extent of help-seeking behaviours and treatments?

The analysis will explicitly draw out the implications of the findings from this study for the prevention of injuries, and for seeking treatment and for help-seeking behaviour once injuries occur.

1.3 Ethics

It is understood that injuries may be a sensitive topic for many musicians. Due to the stigma associated with injuries, the questionnaires were kept private, and anonymous. People taking part in the study had the option to withdraw at any point, or skip any questions that made them feel uncomfortable. Informed consent by the participants was needed for their results to be included in this thesis.

The point of this thesis is not to judge and discredit different university education systems, but rather to identify the shortcomings in the knowledge transferred, in order to ultimately help learners from all over South Africa.

Before questionnaires could be answered, ethical clearance from The University of Stellenbosch and Nelson Mandela University had to be granted. In accordance with the University of Stellenbosch's ethics protocol, gate-keeper permission was required before student contact details could be released.

When administering the questionnaire in person, participants were required to complete a consent form to participate in the research. In telephonic interviews, a consent form was read to the participants; the recorded response during the call provided the verbal proof of consent.

The views expressed in this thesis are my own and should not be attributed to the institution of the University of Stellenbosch.

1.4 Chapter outlines

1. Introduction: The introduction sets the themes and background for this thesis.
    (a) Background: This section expands on the introduction by looking at international programmes and programmes in South Africa.
    (b) Research Question
    (c) Literature review: The literature review gives a broad overview of relevant literature in two different caregories as well as the conceptual framework:
        i. South African literature
        ii. Literature on physiology. This literature is expanded on in Chapter 2.
        iii. Conceptual framework
    (d) Ethics: This section describes the ethical challenges and protocols used in this study.
2. Common musculoskeletal problems suffered by violinists: This chapter is an expansion of the literature review and looks at problems and concerns relating to:
    (a) Tendon problems
    (b) Nerve problems
    (c) Muscular problems
    (d) Postural concerns
3. Research design: The research design creates context for the findings and discussion in Chapter 4.
    (a) Methodology and sample: This describes the way the questionnaire was administered, as well as the participants taking part.

   (b) Questionnaire design: The design describes how the questionnaire was set up, from what literature the questions were founded on and the general structure of the questionnaire.

   (c) Limitations of the study: This describes possible impediments to the study.

4. Findings and discussion: The results of the study are presented, as well as comparisons to other data.

   (a) Data on injuries and help-seeking behaviours

   (b) Availability of information at institutions

5. Recommendations and conclusion: Looking at the results from the previous chapter, a conclusion and recommendations will be provided.

   (a) Recommendations for institutions

   (b) Recommendations for learners

   (c) Recommendations for teachers

   (d) Conclusion

6. Appendix: The appendix will include information used in this thesis that was not presented in the main part of this thesis. It includes the questionnaire, the ethical approval from the different universities, the permission letters from the heads of the departments, and figures referred to in the thesis.

Chapter 2

Common musculoskeletal problems suffered by classical violinists: A literary overview

Based on literature, researchers have identified several musculoskeletal problems that musicians, particularly violinists incur. In this chapter, an extensive look at possible injuries will be discussed along with their presentation, diagnosis, and treatment options. The three focus areas are tendons, nerves, and muscles.

Although a number of common musculoskeletal problems will be discussed, the list of injuries discussed is not exhaustive. The chapter is concluded with postural concerns caused by violin playing and possible complications thereof.

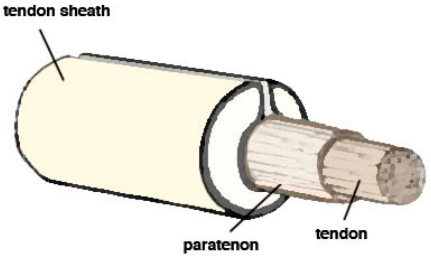
2.1 Tendon problems

Tendons are made up of two main components (Figure 2.1): the tendon itself and the tendon sheath[1] (Watson, 2009). As the tendon is made up of two parts, there are two sets of ailments that may occur; these are often not mutually exclusive.

[1]The tendon sheath is also known as the synovial membrane or sheath.

1. Tendinopathy: A problem relating to the tendon, resulting in one or more of the following:
    - Tendonitis
    - Tendonosis
    - Tendon rupture
    - Tendon tear
2. Tenosynovitis: An inflammation of the tendon sheath, resulting in one or more of the following:
    - Trigger finger
    - De Quervain's tenosynovitis

Figure 2.1: A diagram showing the tendon anatomy (Footcare, 2015)



2.1.1 Tendonitis/Tendonosis

Tendonitis is a common diagnosis amongst sportsmen (Almekinders and Temple, 1998). This too is true for musicians due to the repetitive motion of practice.

Commonly, the term 'tendonitis' is used incorrectly as an umbrella term for conditions such as tendonitis, tenosynovitis, peritendonitis, paratendonitis, tendonosis, and tendinopathy (Almekinders and Temple, 1998). The suffix 'itis', used in the word 'tendonitis', implies inflammation of the tendon or tendon sheath. This diagnosis is often mis-categorised as tendonosis, where '-osis' means degeneration of the tendon. Tendonosis is more common and more serious than

tendonitis, contrary to previous belief (Bass, 2012). It is important for medical professionals to make a distinction between inflammatory tendon problems (-itis) and degenerative processes (-osis) so that the treatment plan may be given accordingly (Bass, 2012).

The term 'tendinopathy' refers to the general injury of a tendon regardless of the type of problem. In essence, tendinopathy should be used as the umbrella term and other terms should be used to correctly describe the type of problem (Bass, 2012).

2.1.1.1 Presentation and diagnosis

For both tendonitis and tendonosis, there will be pain at the point of tendinopathy. In cases of tendonitis, there may be redness or heat on the area, which is caused by inflammation. Tendonosis causes pain of the tendon without inflammation, due to degenerating or degenerated tendons (Khan *et al.*, 2000).

Wood (2016) describes symptoms of tendinopathy as stiffness, swelling, tenderness, and weakness. All of these symptoms can be very problematic to a violinist.

2.1.1.2 Causes

There are several causes of tendinopathy. The most common cause is putting the tendon under strain during activities such as sport or music practice. Other causes include ageing, injury, diabetes, or arthritis (Almekinders and Temple, 1998).

For tendonitis, the cause is usually a specific event or activity that leads to the immediate outcome of inflammation. For a musician, this could mean a very intense schedule for the day, practising a new technique that puts a tendon under strain, or a concert wherein the performer overexerts him/herself. As stated in *Presentation and diagnosis*, these injuries take a short time to heal (Bass, 2012).

For tendonosis, injury over a longer period is the cause. Tendonosis could occur after not giving adequate time for tendonitis to heal, or recurring tendonitis. On a pathological level, tendonosis occurs when the collagen degenerates from repetitive strain to the tendon.

Miller (2017) claims that tendon injuries follow four degrees of severity:

1. Reactive Tendinopathy: This is a healthy reaction to a fast increase in tendon load.
2. Tendon Dysrepair: The recovery time for this level of severity is longer than that of the above. Tendon recovery is active and adequate healing is needed to avoid progression to stage three. In this stage, inflammation may occur.
3. Degenerative Tendinopathy: In this stage, the cells start breaking down, leading to the formation of scar tissue.
4. Tendon Tear or Rupture: This stage is categorised by catastrophic tissue breakdown. Often surgery is the only way to fix the problem.

As mentioned above, the disintegration of collagen occurs through repetitive strain, causing tendonosis. From this we can deduce that musicians' injuries are most likely to be tendonosis and not tendonitis (Brady, 2013).

Brady (2013) gives another very interesting explanation into what causes tendon problems in musicians:

> The repeated or sustained muscular contraction associated with mastering virtually any musical instrument causes a decrease in blood flow to the working muscles and tendons. This lack of blood flow then causes an accumulation of waste products. These waste products are very similar to those produced when a muscle is torn. The waste products in turn attract the cells that produce scar tissue... The

scar tissue increases stress on the tendons and they begin to degenerate.

Brady (2013) goes on to discuss how scar tissue, unlike inflammation, does not resolve with rest. He also goes on to say that traditional methods of treatment, such as anti-inflammatory medication, ice, and rest are no longer the treatment of choice. He suggests active release techniques (ART) as the most appropriate treatment for tendonosis[2].

2.1.1.3 Treatment

Khan *et al.* (2000) state that because tendonitis and tendonosis are two different injuries, the treatment and prognosis will differ. Due to the fact that tendonosis develops over a long period of time, it takes a longer time for the body to recover. Khan *et al.* (2000) say that with tendonosis, recovery time can be anywhere from six weeks to six months, depending on how serious the condition is. With tendonitis, the recovery time is much shorter, spanning several days to six weeks.

For both tendonitis and tendonosis, it is a good idea to look at the activity to see if there is something happening that is causing the problem. For a musician, this could be caused by postural problems. The ideal situation would be to fix the action causing the tendinopathy. It is however not always simple to fix the problem, as some people are predisposed towards tendinopathy (Wood, 2016).

Treatment for tendonitis is aimed at reducing the inflammation (Bass, 2012). Widely accepted treatment for tendonitis is as follows (Khan *et al.*, 2000):

- Cryotherapy (icing the affected area).

[2]The Active Release Technique requires the physiotherapist or doctor to locate the scar tissue through physical examination. The physiotherapist or doctor then places their finger on the scar tissue while the muscle is contracted, and holds their finger on the scar tissue while the muscle is extended. This process breaks down scarring, allowing for smooth movement of the tendon (Brady, 2013).

- Electrotherapeutic techniques such as ultrasound machines and laser treatment to speed up the healing process.
- Nonsteroidal anti-inflammatory drugs.
- Corticosteroid injections.
- Rest.

Tendonosis requires more intense therapy over a longer period of time in order to recover fully. These include (Khan *et al.*, 2000):

- Encouragement of collagen creation to help repair the tendon.
- Collagen creation through strengthening the muscle, which is done through eccentric strength training [3] (Lindstedt *et al.*, 2001; Woodley *et al.*, 2007).
- Physiotherapy will help regain proper movement, remove scarring, and prevent nerve entrapment from occurring (Brady, 2013). A physiotherapist trained in ART is also highly recommended. Khan *et al.* (2000) also suggest using load decreasing devices such as braces or strapping during activities[4].
- Biomechanical correction. This relates to fixing the cause of the problem.
- Surgery is the last resort for people where conservative methods are ineffective. In surgery, scar tissue is removed from around the tendon for it to move freely.

2.1.1.4 Prevention

Prevention of tendinopathy can take many forms, from changing posture to exercising. Foxman and Burgel (2006) discuss some ways that can aid in prevention:

[3] Eccentric training is the motion of an active muscle while it is lengthening under load. Tendinopathy is significantly improved by eccentric exercise.

[4] Due to the fact that braces hinder movement, braces may not be ideal for musicians.

- In the early stages of injury, apply ice to the affected area after practising. Taking anti-inflammatory medication will also help if there is inflammation after playing.
- To avoid tendonosis, playing should be stopped before pain occurs. A player should rather practice for short periods with breaks in between.
- Keep warm; soft tissue is less easily injured when warm. Dedicate a time in your practice session to warm up and stretch.
- Try to assume a natural and neutral body position.
- Employ core strengthening techniques and improve overall strength.
- Avoid smoking. Smoking causes reduced blood flow to soft tissue, hindering recovery.
- Proper nutrition and fluid intake.
- A good amount of sleep.

2.1.2 Tenosynovitis (Trigger finger)

According to Makkouk *et al.* (2008), trigger finger (stenosing flexor tenosynovitis) is caused by the inflammation of the A1 pulley in the digit. This problem presents itself in people who commonly overwork their hands, as is often the case with musicians. This can lead to problems including jamming, clicking, popping, pain, and slow movement of the finger. This can be particularly problematic in musicians where unimpeded movement of the fingers is necessary.

2.1.2.1 Presentation and diagnosis

Proper diagnosis by a medical professional is required to rule out any underlying problems such as arthritis, fracture, tumour, or soft tissue trauma.

The initial presentation of trigger finger will usually be evident by a 'popping' and 'locking' of the finger when extending or flexing. Pain may follow. This is caused by the inflammation of the sheath due to irritation. A small nodule may also appear from the tendon being irritated. This nodule will become bigger if the irritation persists, causing even more irritation (Makkouk *et al.*, 2008).

Imaging such as ultrasound, MRI, and X-rays can be used to rule out other causes. A physical examination by a professional is usually sufficient to diagnose trigger finger.

2.1.2.2 Causes

Makkouk *et al.* (2008) say that there has been no conclusive evidence as to what causes trigger finger, however it often correlates to overuse of the fingers especially in tasks that require a gripping or flexing motion. Other risk factors include age, diabetes, as well as prior tendon problems. These causes place musicians at risk because of the flexing motion involved in placing the fingers on the strings, as well as moving the bow. The extended period of practising is also a risk factor for trigger finger.

2.1.2.3 Treatment

Conservative treatment includes altering the activity, anti-inflammatory medication, joint immobilisation, and corticosteroid injections (Makkouk *et al.*, 2008). For a violinist, this would translate into several treatment options. The first would be to rest the hand for a short period of time to allow for the tendon to recover. Anti-inflammatory medication can be used to help with pain and quicken the healing process. The musician may also require a splint to immobilise the hand. Cold and hot therapy could also be helpful for trigger finger.

If these treatments do not work, the doctor may suggest a corticosteroid injection into the affected area. Surgical treatment would include an incision in the palm of the hand wherein the surgeon will cut open the tendon sheath, releasing the tendon (Makkouk *et al.*, 2008).

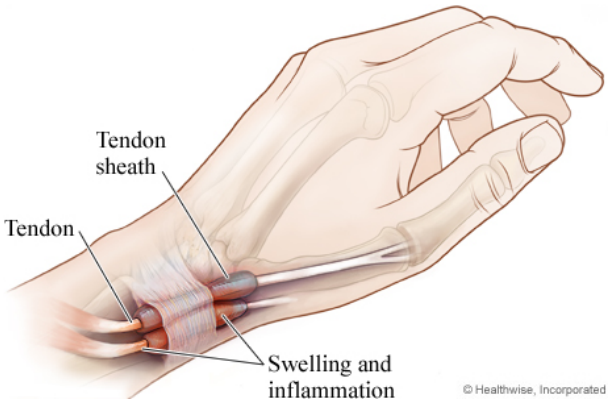
2.1.3 De Quervain's tenosynovitis

De Quervain's tenosynovitis is a type of injury caused by inflammation of the tendons on the radial side of the hand (thumb side) (Katechia and Gujral, 2017).

2.1.3.1 Presentation and diagnosis

De Quervain's tenosynovitis usually presents as pain or tenderness on the radial side of the hand (Katechia and Gujral, 2017), and is commonly associated with overuse. This condition presents six to ten times more in women than in men (Mehdinasab and Alemohammad, 2010, 270).

Figure 2.2: An illustration showing de Quervain's tenosynovitis (Healthwise Incorporated, 2018)



2.1.3.2 Causes

According to Mehdinasab and Alemohammad (2010), de Quervain's tenosynovitis is caused by repetitive strain. The sheath of the tendon becomes inflamed and restricts the tendon from gliding smoothly.

2.1.3.3 Treatment

The primary step to treating de Quervain's tenosynovitis would be immobilisation of the wrist. This treatment is particularly helpful if administered in the first six weeks of injury (Mehdinasab and Alemohammad, 2010, 270). The use of corticosteroid injections (namely, Methylprednisolone Acetate) has also been proven to be effective in treating de Quervain's tenosynovitis. In a study by Mehdinasab and Alemohammad (2010, 270), the use of a splint shows a 36.1% success rate, whereas the use of a Methylprednisolone Acetate injection in conjunction with a splint shows an 86.5% success rate.

A more radical treatment would be an operation wherein the tendon sheath is cut, releasing the tendon and allowing it to move freely. A possible complication would be the tendon dislocating as the sheath no longer holds it in place (Watson, 2009, 84).

2.1.3.4 Rotator cuff injury

According to Merriam-Webster Online (2017), the rotator cuff is "a supporting and strengthening structure of the shoulder joint that is made up of the capsule of the shoulder joint blended with tendons and muscles as they pass to the capsule or across it to insert on the head of the humerus".

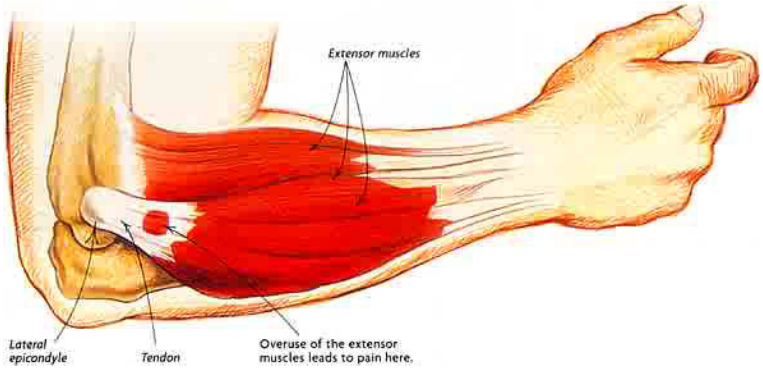
The four main muscles that form the rotator cuff are the: Subscapularis, Supraspinatus, Infraspinatus, and Teres minor muscles. As with any other muscle and tendon injuries: tendonitis, torn tendon, and tendinopathy are the usual cause of pain and movement problems. Other problems that may occur with the shoulder include bursitis, frozen shoulder, and calcific shoulder. These conditions are not commonly associated with performance-related injuries (Merriam-Webster Online, 2017).

2.1.4 Epicondilitis (Tennis elbow)

Tennis elbow occurs when there is inflammation of the tendons that connect the elbow to the forearm. The main cause of tennis elbow is repetitive movement of the elbow (Wellbeing Health Clinic, 2017). Although the name suggests that it occurs in tennis players, any activity that causes repetitive motion puts one at risk. Epicondilitis causes pain in the arm and weakness of grip.

It is important to consult a healthcare professional for a diagnosis to rule out any neurological involvement[5].

Figure 2.3: An illustration showing epicondilitis (Wellbeing Health Clinic, 2017)



2.1.4.1 Diagnosis

At the initial consultation, the patient's medical history will be studied and a physical examination will be conducted. Pieren *et al.* (2017) state that the physical examination would include palpating the affected area to locate the pain. The patient will also be asked to extend the hand (backwards), resisting a force to check for pain and weakness. From there, the physician may require imaging such as an MRI or an ultrasound to assess the area and surrounding structures [Pieren *et al.* (2017)[6]].

[5]Nerve entrapment at the elbow can cause inflammation in the surrounding tendons. This could present as epicondilitis with neuropathy being the underlying cause (Wellbeing Health Clinic, 2017).

[6]In the study by Pieren *et al.* (2017), it was established that X-rays were not useful in diagnosing epicondilitis.

2.1.4.2 Treatment

Several treatment options are available for tennis elbow, although most cases are self-resolving over 12 to 18 months (Sims *et al.*, 2014, 443).

Conservative treatments include corticosteroid injections (Sims *et al.*, 2014, 443), non-steroidal anti-inflammatory drugs (such as aspirin or ibuprofen) (Pieren *et al.*, 2017), and splinting.

A study by Bisset *et al.* (2006) looked at the long-term outcome of different conservative treatments, namely, corticosteroid injections, physiotherapy, and "wait and see". Over a six week period, injections and physiotherapy showed a better success rate than the "wait and see" group. From 6 to 52 weeks, the injection group showed a decline in success and ultimately leading to a much lower success than physiotherapy or "wait and see".

At 52 weeks, physiotherapy had a higher success than the "wait and see" group. From this, Bisset *et al.* (2006) conclude that physiotherapy and injections were good for short-term treatment, however, physicians should take caution when using injections over an extended period of time. Surgical intervention will be required in the case of 8% of patients with epicondilitis (Coleman *et al.*, 2010, 364).

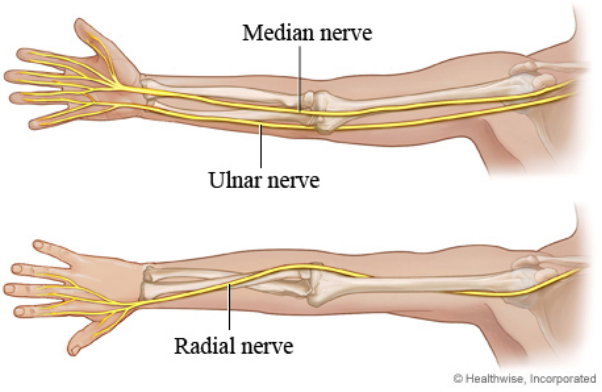
2.2 Nerve problems

Nerve problems are commonly characterised by numbness or tingling in the arms and fingers. Nerve problems are generally caused by pre-existing structural abnormalities (Winspur and Parry, 1998, 85) and/or from aggravation of the nerve through posture and repetitive strain (Lukomski, 2004, 5). Another common problem found in musicians is that scar tissue from previous tendon injuries grips the nerve and causes nerve compression.

Nerve compression happens when there is pressure on the nerve (running from the upper extremity, i.e., neck to the extremities). This stops the nerves

from sending and receiving signals properly. The umbrella term for the majority of nerve problems is called "nerve compression syndrome", wherein carpal tunnel syndrome and thoracic outlet syndrome are the most common problems (Winspur and Parry, 1998, 85).

Figure 2.4: An illustration showing the main nerves of the arm (Blahd and Messenger, 2015)

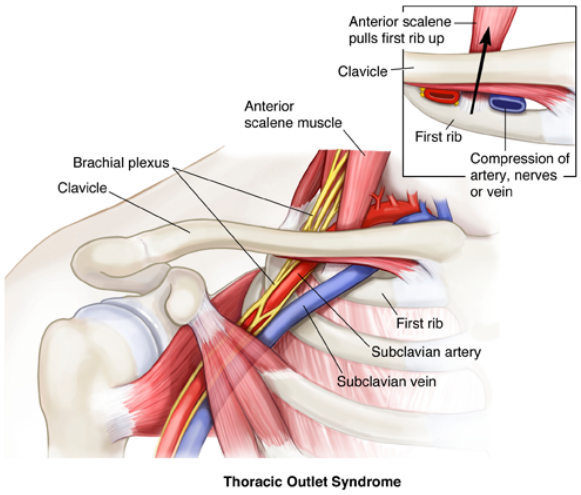


The arm is made up of three main nerves: namely, ulnar nerve, median nerve, and radial nerve. These nerves run from the cervical spine (the neck) all the way into the fingers (Watson, 2009, 64). Any problem that may occur along the nerve may cause pain or numbness in the hand or fingers, as well as referred pain up the nerve. This may cause difficulty when diagnosing the cause of the problem as the nerve entrapment is not always where the pain is felt.

2.2.1 Thoracic outlet syndrome (Brachial plexus compression)

If one starts at the origin of the nerve (the cervical spine, i.e., the neck) and works towards the hand, one of the first problems that can occur is thoracic outlet syndrome (TOS). This is where the nerves (brachial plexus) are restricted on their way from the neck to the armpit (National Institute of Neurological Disorders and Stroke, 2017). The brachial plexus is usually compressed between the first rib and the collar bone.

Figure 2.5: An illustration showing the thoracic outlet (Blahd and Messenger, 2015)



The causes of thoracic outlet syndrome are (Mayo Clinic, 2016):

- Anatomical defects, like having an extra cervical rib or a tight fibrotic band connecting the rib to the spine.
- Poor posture, such as slouched shoulders or a posture in which the head is protruding forward.
- Pressure on the joints from obesity or carrying around a heavy bag.
- Pregnancy.
- Trauma.

2.2.1.1 Diagnosis

According to the National Institute of Neurological Disorders and Stroke (2017), TOS can be quite difficult to diagnose as the symptoms created by TOS are similar to many other conditions. These include: loss of muscle in the thumb (Gilliatt-Sumner syndrome); numbness and tingling in the arm or hands; pain in the neck,

arm, or hand; and weakness in the arm (Mayo Clinic, 2016).

There are several ways in which a medical professional can diagnose TOS. The first step being a detailed medical history in which questions pertaining to occupation will be asked. The doctor may need to see how the musical instrument is being held to deduce if posture is the main cause of the problem.

Provocative tests, in which the medical professional will attempt to recreate the pain through movement, may be performed (Mayo Clinic, 2016). Other diagnostic tests may include nerve conduction studies, electromyography, or imaging studies (National Institute of Neurological Disorders and Stroke, 2017).

2.2.1.2 Treatment

The treatment for TOS ranges from conservative to surgical intervention. The initial treatment would usually be physiotherapy, where the muscles are stretched and strengthened to allow for better posture and better motion. This will in turn allow for pressure to be reduced in the thoracic outlet, allowing nerves to transmit signals and move better through the cavity (Mayo Clinic, 2016). The use of anti-inflammatory medication may also be prescribed in order to reduce muscle inflammation around the thoracic outlet. A more radical treatment would be to operate and remove either the uppermost cervical rib and/or the fibrous tissue pressing on the brachial plexus (Mayo Clinic, 2016).

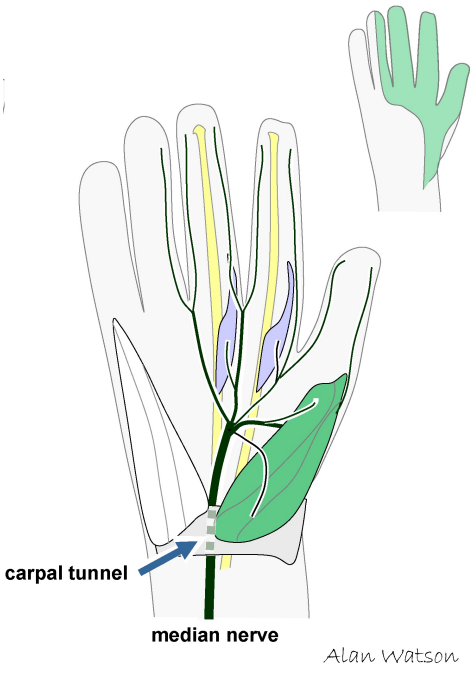
2.2.1.3 Thoracic outlet syndrome in string players

Violinists and violists are particularly susceptible to TOS due to the narrowed outlet caused by the rotated and lifted left arm. Postural changes, as well as strengthening exercises (such as Alexander Technique [Winspur and Parry (1998)]) can help to support the shoulder and open up the thoracic outlet.

2.2.2 Carpal tunnel syndrome

Carpal tunnel syndrome (CTS) is caused by compression of the median nerve under the carpal ligament. Carpal tunnel syndrome (Lukomski, 2004, 5) causes numbness, tingling, and loss of motion in the thumb, index finger, and the median side of the middle finger. According to Chen *et al.* (2015), carpal tunnel syndrome is the most common focal peripheral neuropathy problem.

Figure 2.6: An illustration showing the carpal tunnel (Watson, 2009, 64)



2.2.2.1 Diagnosis

The diagnosis of carpal tunnel syndrome will be made by a doctor by means of a physical examination. The first test that can be done by a doctor is to tap on the carpal ligament to see if it produces the same effects that the patient feels. Other tests such as an EEG or MRI scan can be conducted to establish the severity of the CTS, as well as the proper treatment course (Chen *et al.*, 2015).

2.2.2.2 Treatment

Although 34% of mild to moderate cases of CTS have spontaneous improvement (Chen *et al.*, 2015), there are many different treatments for carpal tunnel syndrome including rest, splinting, physical therapy, ultrasound therapy, corticosteroid injections, and carpal tunnel release surgery. In a study by Soon *et al.* (2015), splinting showed to be one of the most effective conservative treatments for carpal tunnel syndrome.

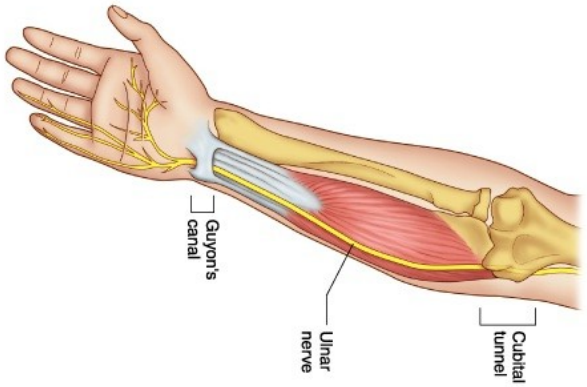
with regard to surgical intervention, all participants who had received surgery showed positive results. Soon *et al.* (2015) found that there was no significant improvement in participants who used other non-surgical techniques in conjunction with splinting. However, none of the other treatments showed any negative long-term effects. Usually, before performing invasive surgery, corticosteroid injections will be used (Chen *et al.*, 2015).

A guided ultrasound is used to effectively locate where the injection will be administered. These steroid injections reduce swelling and thereby improve the motion of the median nerve. Steroid injections can also be a helpful indicator as to how well a surgery would work on the patient (Kulick *et al.*, 1986). According to Kulick *et al.* (1986, 65), the long-term success rate of carpal tunnel release surgery is between 7% and 20%. Kulick *et al.* (1986) suggest that the success of the surgery would be higher if the patient had the surgery earlier.

2.2.3 Ulnar tunnel syndrome (Guyon Tunnel)

Guyon tunnel syndrome is very similar to carpal tunnel syndrome with regard to diagnosis, as well as treatment. Where carpal tunnel affects the median nerve in the wrist, Guyon tunnel affects the ulnar nerve in the wrist (Eorthopod online, 2016).

Figure 2.7: A diagram showing path of the ulnar nerve (Tulag, 2013)



2.2.3.1 Diagnosis

The diagnosis of Guyon tunnel syndrome will be made by a doctor by means of a physical examination. Symptoms will present as pain, numbness, and/or tingling in the little finger and half of the ring finger. Other symptoms may include weakness and muscle loss on the little finger's side of the hand (Eorthopod online, 2016).

Aguiar *et al.* (2001) state that an X-ray or MRI is used to see any underlying problems such as a ganglion or dislocation that may be pressing on the ulnar nerve.

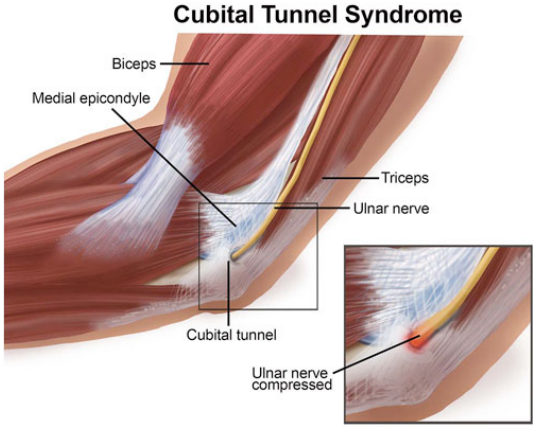
2.2.3.2 Treatment

The treatment with Guyon tunnel syndrome will be similar to that of carpal tunnel, i.e., rest and bracing the wrist. However, if there is an underlying cause, such as a ganglion, surgery will be needed to resolve the underlying problem (Aguiar *et al.*, 2001).

2.2.4 Cubital tunnel syndrome

Cubital tunnel syndrome occurs when the ulnar nerve is compressed when going through the cubital tunnel (Figure 2.8) (Palmer and Hughes, 2010). Symptoms of ulnar nerve compression are numbness and weakness in the little finger and the outer half of the ring finger.

Figure 2.8: A diagram showing ulnar nerve entrapment at the cubital tunnel (Bise, 2012)



Later stages of cubital tunnel syndrome will present with difficulty gripping, muscle loss, and hand deformity, known as 'ulnar claw hand' (Bise, 2012). Cubital tunnel syndrome is most commonly found in people where elbow flexion is common (the elbow being bent), as well as people who perform repetitive motions with the elbow in this position (Cutts, 2007). This puts violinists at high risk for this injury. Another factor that puts violinists at higher risk is the use of the flexor carpi ulnaris muscle when playing in high positions (Norris, 1993, 11).

2.2.4.1 Diagnosis

A comprehensive history will be taken by the physician, including information on what aggravates the injury and what alleviates the symptoms. According to Palmer and Hughes (2010), patients with symptoms that subside are more likely to have a positive outcome from surgery or bracing.

According to Cutts (2007), nerve conduction studies are usually used to diagnose cubital tunnel syndrome. Other tests such as MRI scans and X-rays may be used to rule out any underlying condition or see a structural problem that could be causing compression.

2.2.4.2 Treatment

As with most conditions, there is conservative treatment and surgical treatment. Conservative treatments listed by Palmer and Hughes (2010) include posture modification, splinting, and nerve mobilisation (nerve gliding exercises). Out of patients with mild to moderate cubital tunnel syndrome, 89.5% of patients showed an improvement at their follow-up appointment. with regard to posture modification, adjusting the amount of supination (twist) in the left arm may relieve symptoms (this can be done by adjusting the violin hold, as well as the shoulder rest) (Norris, 1993, 36).

Splinting of the elbow at night shows successful outcomes. The splint stops the elbow from bending more than 90 degrees while sleeping; this stops night time compression. Nerve gliding exercises help the nerve move through the tunnel smoothly and can be taught to the patient by the physician (Palmer and Hughes, 2010).

The last treatment option for cubital tunnel syndrome is surgery. In this surgery, the surgeon will use one of several techniques to release the ulnar nerve from the compression at the elbow. These techniques include moving the nerve out from the cubital tunnel (between the bones in the elbow) and to the inside of the arm, allowing for unobstructed movement of the nerve.

2.3 Muscular problems

2.3.1 Overuse and fatigued muscles

Muscle fatigue is defined by the inability to maintain intensity over a period of time (Llobet and George, 2007, 9). This is the body's natural way of avoiding more serious injury, however, chronic fatigue of the muscles can be a problem on its own. Chronic muscle fatigue is characterised by tiredness, tension, and soreness after performing an activity.

Chronic muscle fatigue can be caused by several factors (Llobet and George, 2007), such as the:

1. Intensity of performance.
2. Length of performance.
3. Speed of movements.

From this we can form a series of diagrams representing different circumstances that could lead to injury (Llobet and George, 2007).

- Intensity + speed + duration = injury.
- Intensity + speed - long duration = safe.
- Long duration + low intensity + low speed = safe.

The problem arises when the player cannot dictate the distribution of these three factors, such as during rehearsals (Llobet and George, 2007, 3). Orchestral musicians can help prevent injury and counteract muscle strain by stretching during breaks, postural improvement during rehearsals, and more ergonomic movements when playing.

There are other causes of fatigue that cannot be blamed on performing/ playing one's instrument. Factors that promote chronic muscle fatigue include sleep patterns, diet, and other unrelated diseases.

2.4 Postural concerns

Postural problems can be a large cause of performance-related injuries. Making sure a student or performer has the correct instrument set-up and correct posture can help avoid playing-related problems or the severity thereof. In the Cambridge companion to the Violin (Eales, 1992, 107), several postural concerns and outcomes are mentioned as well as stating that the optimum state of playing is "balance, motion, and relaxation".

Eales (1992, 107) suggests reflection on playing techniques, as many of the postural problems are deeply-rooted habits. The use of audio-visual equipment is particularly useful to identify problems. The most frequently observed problems will present as facial contortions, rapid breathing, twisted spine, a stiff neck, and a high left shoulder. The presence of this stiffness is one of the main causes of musculoskeletal problems among musicians.

An issue commonly arising with string players, is the use of curved plastic chairs during rehearsals (Eales, 1992). The curvature in the chair causes the spine to curve and the ridge of the chair cuts off the blood flow to the legs. The Cambridge companion to the Violin (1992, 101) suggests the use of a supporting cushion in these circumstances.

When standing and playing the violin, Flesch (1924, 14) suggests "the spread or straddling leg-position", where the legs are separated (the distance of the shoulder) and no leg is in front of the other. This position offers stability to the performer, as well as allowing them freedom to move with the upper body while playing. Flesch (1924) suggests that students and performers be allowed to move their bodies so as not to promote stiffness, while keeping the movements small enough not to waste the student's energy.

Watson (2016, 28) states that strengthening the muscles that support the spine is generally the most suitable treatment for back pain. Watson (2016, 29) describes some of the postural changes that can be applied to lessen the risk of injury and pain. Firstly, the musician should choose the standing position where possible, as it causes less pressure between the vertebral disks in the spine. Caution should be taken when standing so as not to slouch the upper spine by leaning forward. A cause of this slouch or curvature of the spine could be the music stand being too low or could reflect eyesight problems. Watson (2016, 29) states that if the cause of the slouch is the weight of the instrument, conscious effort must be made to build up the strength of the spinal muscles. Strengthening can be done by taking short breaks when the back gets painful, and slowly increasing the length of playing time as the player sees fit.

There are two main techniques used in South Africa for body awareness and postural improvement: the Alexander Technique and body mapping.

2.4.1 Alexander Technique

The Alexander Technique, which was created by Frederick Matthias Alexander, was initially created for actors to improve performances and treat a wide number of complaints (Stevens, 1996, 19). The use of the Alexander Technique creates awareness of the body and how it is meant to be used. It aims to rewire the participants' thinking to make the most ergonomic movements, as well as practically applying knowledge on spinal support and many other aspects that can dramatically improve posture and musculoskeletal problems.

This technique was adopted by dancers and musicians. Alexander Technique begins by teaching simple actions, such as sitting, standing walking, and lying down. Incorrect body use and harmful habits are pinpointed in these simple activities. The goal is to create awareness in order for the body to work in a free and more natural way (Stevens, 1996).

There is a vast amount of literature on the benefits and use of the Alexander

Technique for musicians. Below is a list of sources that can be referred to for further reading:

- How to learn the Alexander Technique: A manual for students (Conable and Conable, 1995).
- Body awareness in action: a study of the Alexander Technique (Jones, 1979).
- Body learning: An introduction to the Alexander Technique (Gelb, 1995).

2.4.2 Body mapping

Body mapping is a recent technique that has branched off of the Alexander Technique. Unlike the Alexander Technique, body mapping was created for musicians specifically (Buchanan and Hays, 2014). In body mapping, a sixth sense called kinaesthetic sense is explored. Kinaesthetic sense is the ability to sense limb position and limb movement (Proske and Gandevia, 2009), and to use this sense to distribute attention throughout the body.

The act of the participant body mapping with a visual representation of their body gives the body mapping specialist insight into how the participant views their body. The incorrect perception of the body creates incorrect usage of the body. Through education and activity, the participant learns to create a more accurate body map in their brain (Proske and Gandevia, 2009).

2.4.3 Set-up of the violin

In Figure 2.9 the awkward posture of violin playing can be seen. Watson (2016) discusses methods to minimise the spinal curvature, including chin rests, shoulder rests, and the violin hold. A shoulder rest and a higher chin rest could avoid the need for the violinist to lift the left shoulder when holding the violin. Watson (2016) states that even though chin rests and shoulder rests are readily available, they often do not provide the flexibility to suit an individual's need. It is suggested in this case to look at custom-built shoulder and chin rests to suit

the individual violinist. Bejjani *et al.* (1996) discuss the advantages and disadvantages of using a higher shoulder rest. A higher shoulder rest results in a smaller curvature of the cervical spine.

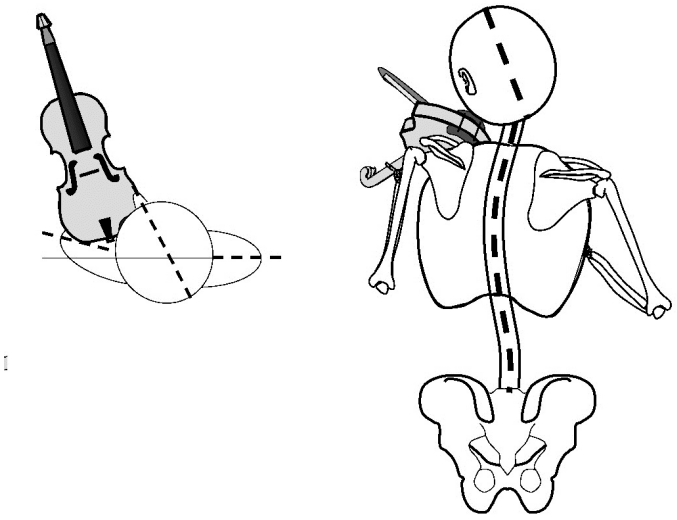


Figure 2.9: Playing posture for the violin (Watson, 2016, 32)

Although the use of a shoulder rest shows positive results for the cervical spine, the limitation of movement of the violin can cause other problems for the violinist. An example of this would be the increased rotation of the left arm when playing on lower strings. Without a shoulder rest, the violin is able to rotate inwards, minimising the need for extreme rotation of the left arm. An option, used by many performers, is the use of a Huber cushion or shoulder pad. This gives the advantage of filling space between the violin and the shoulder, while still allowing movement and rotation of the violin (Bejjani *et al.*, 1996).

Bejjani *et al.* (1996) encourage experimental use of different shoulder rests and shoulder pads to find what works the best for each individual violinist. The set-up and use thereof should often be re-evaluated, especially in young students who are growing.

Chapter 3

Research design

This chapter covers and clarifies the methodology, the questionnaire design, and the limitations of this study. Understanding these topics will put the findings of the study in a better context.

3.1 Methodology and sample

A number of ethical procedures had to be completed before the administration of the questionnaire could take place. Approval was granted for questionnaires to be administered in person, telephonically, or via email (electronically). For the eight undergraduate students at the University of Cape Town, the questionnaire was administered in a group setting. The researcher gave a short background of the research to the group of participants. While answering the questionnaire, participants were allowed to ask questions if they needed any clarity. Participants were reassured that their answers would remain anonymous.

Emails were sent to all other possible participants at other universities; however, there were no responses via email. Emails were followed up by phone calls or messages asking for a convenient time to complete the questionnaire. Six questionnaires were conducted telephonically.

During these calls, participants were also allowed to ask questions if they were unsure of what was being asked. The study was conducted between the 22 nd May

and the 15 th September 2018.

The participant pool could have been broadened by removing restrictions for participation; however, the purpose of the study was not to gather as much information as possible but rather to gather a smaller, more relevant sample on injuries.

Criteria for participation in the study:

1. Be a bachelor of music student (BMus).
2. Have violin as their first instrument.
3. Be in third year, fourth year, or have graduated in the previous year.
4. Be specialising in performance or general BMus.

The reason behind these stipulations was to gain a focused group of participants with similar daily schedules and tasks. In the final two years of BMus (third and fourth year), students have had time to adjust to the increased practising demands of university.

Of the 17 universities in South Africa, 10 universities[1] offer a BMus degree. Currently only four of the universities have students that fall within the criteria for the survey.

The total number of students who matched the criteria was 18. The final number of students answering the questionnaire was 14 (response rate of 78%).

The number of students who answered the questionnaire from each university:

[1]The University of Stellenbosch, University of Cape Town, University of Pretoria, University of the Free State, University of KwaZulu-Natal, University of Fort Hare, Nelson Mandela University, University of the Witwatersrand, North West University, and UNISA.

Institution	
University of Cape Town	9
University of Stellenbosch	2
University of Pretoria	2
Nelson Mandela University	1

The number of students that were unable to answer the questionnaire were:

Institution	
University of Cape Town	2
Rhodes University	1
University of Pretoria	1

The year of study of each participant:

Year	Frequency
Third Year	3
Fourth year	9
Graduated last year	2
Total	*14*

3.2 Questionnaire design

A survey was used, incorporating a combination of closed and open-ended questions. For the closed part of the survey, a mix of binary and a ranking scale similar to that used in the DASH method[2] was used.

[2]The DASH method is discussed further in the literature review by Ajidahun *et al.* (2016) and the Likert scale forms an integral part of the DASH method. This method was developed to measure attitudes by asking people to respond to a series of statements about a topic in terms of the extent to which they agree with them (Ajidahun *et al.*, 2016; Sullivan and Artino Jr, 2013).

The questionnaire is divided into four main sections. The first is 'General information', which establishes basic information about the participants (such as age, gender, and hours practiced daily), as well as information to confirm that the participant fits the criteria for the study (course, year, and main instrument).

In the second section the participants were asked to mark the location and severity of pain. Participants were also asked to select the different symptoms that they have experienced (such as stiffness, tingling, and pain). This section is based on the DASH system as discussed in Chapter 3 (*Research design*). The third section questions how the problem has affected the participants' practice, daily activities, and the duration of the playing-related problem.

The fourth section questions how the participant have gone about diagnosing and treating the problem, whether the treatment has worked, and whether or not the information gained is still being used. A few final questions were asked to establish whether they have been given injury prevention/help by their institution, and what they would hypothetically like to be put in place to help themselves and others with playing-related problems.

3.3 Limitations of the study

The questionnaire was designed to be multiple choice with close-ended questions[3] for the majority of the questions. Although the questions were mostly based on questionnaires from other studies (in order to compare findings), the multichotomous nature of the questionnaire presented some problems. For example, the structure of the questions gave participants fixed answers from which they could choose, which would cause a discrepancy in the data if the participant did not perceive any of the answers to be fitting, or had a different interpretation of the question being asked (Hyman, 1955).

Another limitation is the fact that students were not asked whether they merely

[3] "Questions of this type offer a range of possible answers, similar to a multiple-choice test. They tend to be easier on the respondent and equally on the questionnaire-interpreter later on" (Beiske, 2002).

consulted a health professional or were actually treated by a health professional. Guptill *et al.* (2000) make this distinction and found that only about half the students who consulted a health professional were actually treated by a health professional. A distinction would have allowed for the 'effectiveness of treatment strategies' to be better understood.

The questionnaire was formed in order to gain information on both playing-related problems, as well as the rate of help-seeking behaviour. Although much of the data can be quantified, the number of participants is too low to draw strong statistical conclusions. The small sample pool (14 participants) could be seen as a limitation as it does not allow for strong statistical correlations and conclusions to be made, however, the requirements for participation in the study made the possible sample pool small. It was however necessary for the strict requirements, despite the limitation on sample size, because more specific data on violin-related injuries was needed.

Chapter 4

Findings and discussion

This chapter merges the findings and discussion in order to properly contextualise the findings made in this study. Findings from this study are also compared to findings in international and national studies to compare injury rates, resources offered, and help-seeking behaviours.

According to Ajidahun *et al.* (2017, 4,6), females generally have a higher rate of musculoskeletal disorders from playing instruments. This could be because of the smaller physiology of a female or because women have a higher likelihood of reporting injuries and seeking help. Ajidahun *et al.*'s (2017) findings correspond with the findings of Davies and Mangion (2002), Wilson *et al.* (1991), Sheibani-Rad *et al.* (2013), and Hohls (2010, 115).

Guptill *et al.* (2000, 87), however, show that there is little to no significance between gender and actual injuries:

> Demographic information about the participants was first examined. Of the students who responded, 41.9% (of a total 108 responses) were male, while 58.1% were female. This distribution corresponds to the School of Music's information about the gender split at the university. 56 of 61 (91.8%) females and 36 of 44 (81.8%) males reported having had an injury at some point in their lives. Chi-square[1] sig-

[1]Chi-square test is one of the important nonparametric tests that is used to compare more than two variables for a randomly selected data (Chegg, 2018).

nificance tests were calculated between gender and injury rates, but these were not found to be significant.

Gender	Frequency
Female	3
Male	9
Total	*14*

In this thesis there is little evidence that suggests a link between gender and playing-related problems or gender and help-seeking behaviour. A chi-squared test was conducted to ascertain the relationship between gender and severity of symptoms. The score was calculated out of 25 (by calculating the total scores given to each symptom). As seen in Figure 4.1, there is no significant correlation between gender and severity of symptoms in this study.

Please rate the severity of the following symptoms in the last week.

Please mark using an "x" in the relevant column.

	1 None				5 Severe
Arm, shoulder or hand pain					
Arm, shoulder or hand pain when performing any specific activity					
Tingling (pins and needles) in your arm, shoulder or hand					
Weakness in your arm, shoulder or hand					
Stiffness in your arm, shoulder or hand					

	score below 12	12 or above	*Marginal Row Totals*
male	2 (1.5) [0.17]	1 (1.5) [0.17]	3
female	5 (5.5) [0.05]	6 (5.5) [0.05]	11
Marginal Column Totals	7	7	14 (Grand Total)

The chi-square statistic is 0.4242. The p-value is .514828. This result is *not* significant at $p < .05$.

Figure 4.1: Chi-squared test comparing gender and severity of symptoms

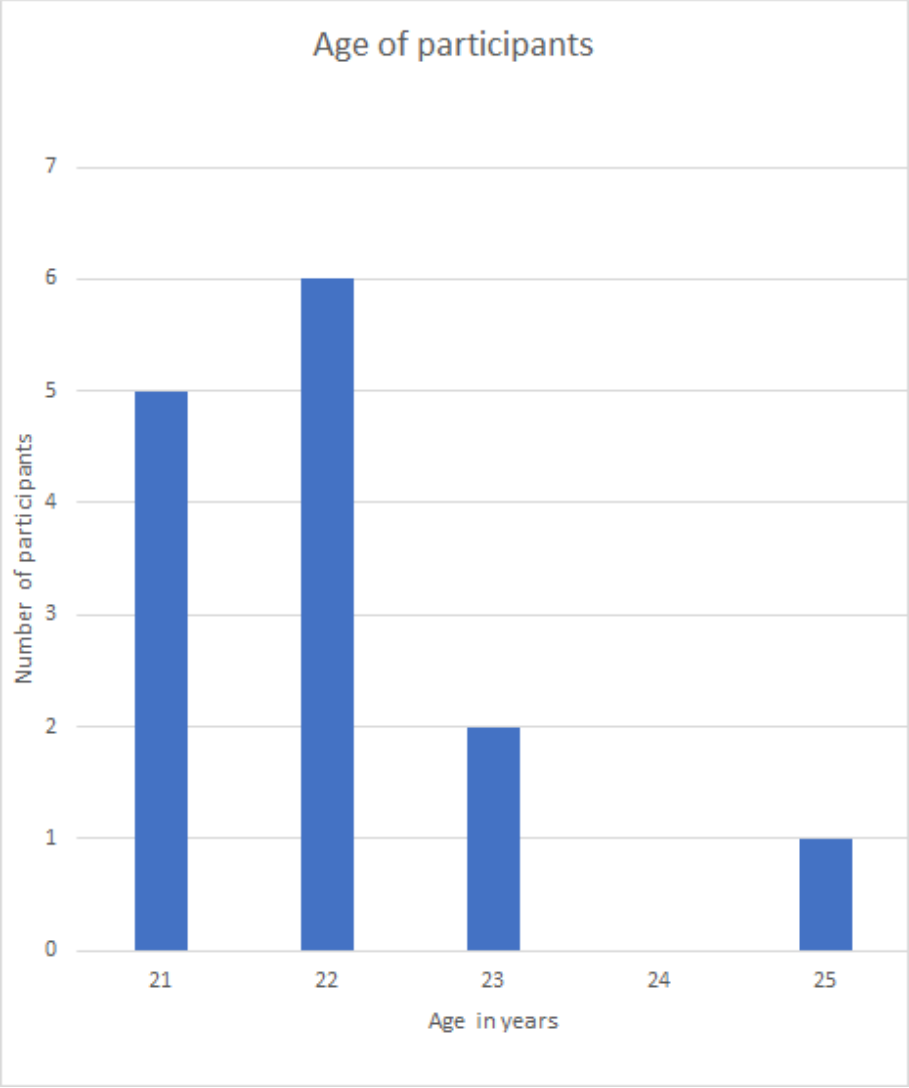


Figure 4.2: Age of participants (N=14)

Allsop and Ackland (2010) state that the age of a musician has an effect on the risk of injury, with injuries increasing as age progresses. The biggest obstacle in quantifying results is that reports of injuries do not necessarily relate to an injury being present. As with gender (where female participants may be more likely to report injuries), age may also be a contributing factor in reports on injuries. Allsop and Ackland (2010) state that people of an older age have a higher rate of reporting injuries, whereas Pak and Chesky (2001) state that younger musicians have higher injury reports.

In this thesis, the age of participants ranges from 21 to 25 years, with the majority of participants being 22. There is no evidence from the data collected that students of different ages had different injury rates.

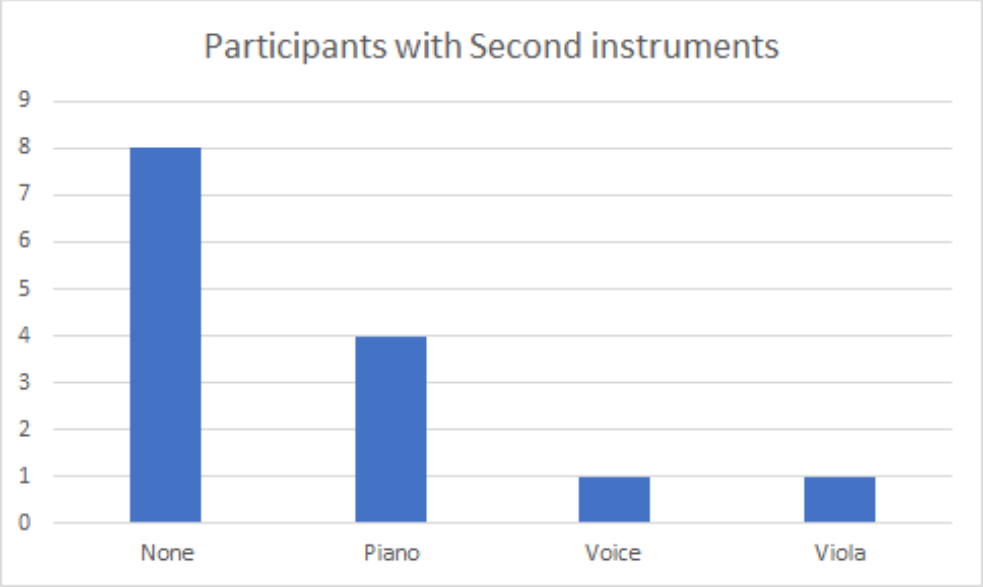


Figure 4.3: Participants with second instruments (N=14)

	Score below 12	Score above 12	*Marginal Row Totals*
Have a second instrument	1 (3) [1.33]	5 (3) [1.33]	6
Have no second instrument	6 (4) [1]	2 (4) [1]	8
Marginal Column Totals	7	7	14 (Grand Total)

The chi-square statistic is 4.6667. The p-value is .030754. This result is significant at $p < .05$.

Figure 4.4: Chi-squared test on participants with second instruments

With regard to the effect of playing a second instrument, Thaele (2016, 54) states that there is no conclusive evidence on whether it affects the risk for musculoskeletal problems. From the data collected in this study, a significant result

(calculated with the Chi-squared test, Figure 4.4) was seen between participants with second instruments and those without a second instrument. Participants with second instruments were much more likely to have more severe symptoms compared to those without second intruments. This could be due to the additional strain on muscles, tendons, and nerves during the second instrument's practice sessions.

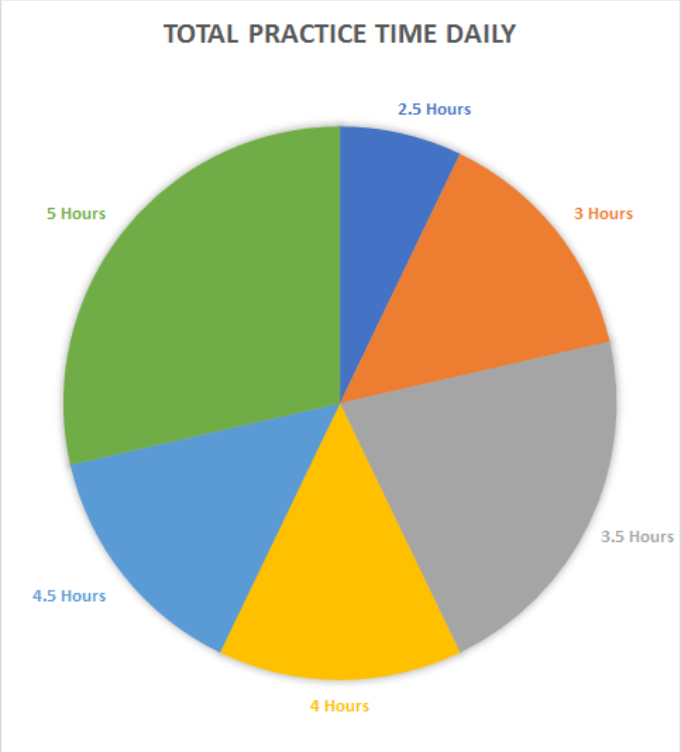


Figure 4.5: Total practice time daily (N=14)

In this study, no differentiation between hours spent practising alone versus orchestral practice was made. The chi-squared statistic (Figure 4.6) shows a rate of 0, which means that there is no correlation between practice time and injury severity. The average time spent practising on their main instrument daily was four hours, with a range from 2.5 to 5 hours (Figure 4.5).

According to Allsop and Ackland (2010, 68), there is a strong correlation between how many hours a pianist practised in a week and the rate of injury. In a

study by Kaufman-Cohen and Ratzon (2011), time spent in orchestral rehearsals correlates to a higher rate of injuries.

Results						
	score below 12	score 12 or above				*Row Totals*
2.5-3.5 hours practised	3 (3.00) [0.00]	3 (3.00) [0.00]				6
4-4.5 hours practised	2 (2.00) [0.00]	2 (2.00) [0.00]				4
5 hours practised	2 (2.00) [0.00]	2 (2.00) [0.00]				4
Column Totals	7	7				14 (Grand Total)

The chi-square statistic is 0. The p-value is 1. The result is *not* significant at $p < .05$.

Figure 4.6: Chi-squared test on practice time daily and severity of symptoms

Another important factor to consider is that the results are dependent on student feedback, which may result in skewed data. The possibility that students cannot practise for long periods due to a pre-existing problem may even equate to a negative correlation between practice time and the presence of injuries.

4.1 Data on injuries and help-seeking behaviours

The prevalence of injuries can be seen in Figure 4.7. All of the students reported having pain in the last 12 months, with just under three-quarters (71%) reporting that they had current pain. The shoulder was the highest source of pain over the last 12 months, with about two out of three (64%) students being affected. This is followed by the upper back and hand pain being present in half the participants (50%). The neck showed the highest rate of current pain at 43%, being equal to the amount of pain in the last 12 months.

Compared to other studies, these statistics are high. Leaver *et al.* (2011) state that in British Symphony orchestras, 86% of players had experienced pain in the last 12 months; this includes all symphony musicians, not only violinists. String players generally experience the most upper limb problems, with shoulders being the area with the most problems (Kaufman-Cohen and Ratzon, 2011; Willia-

mon and Thompson, 2006).

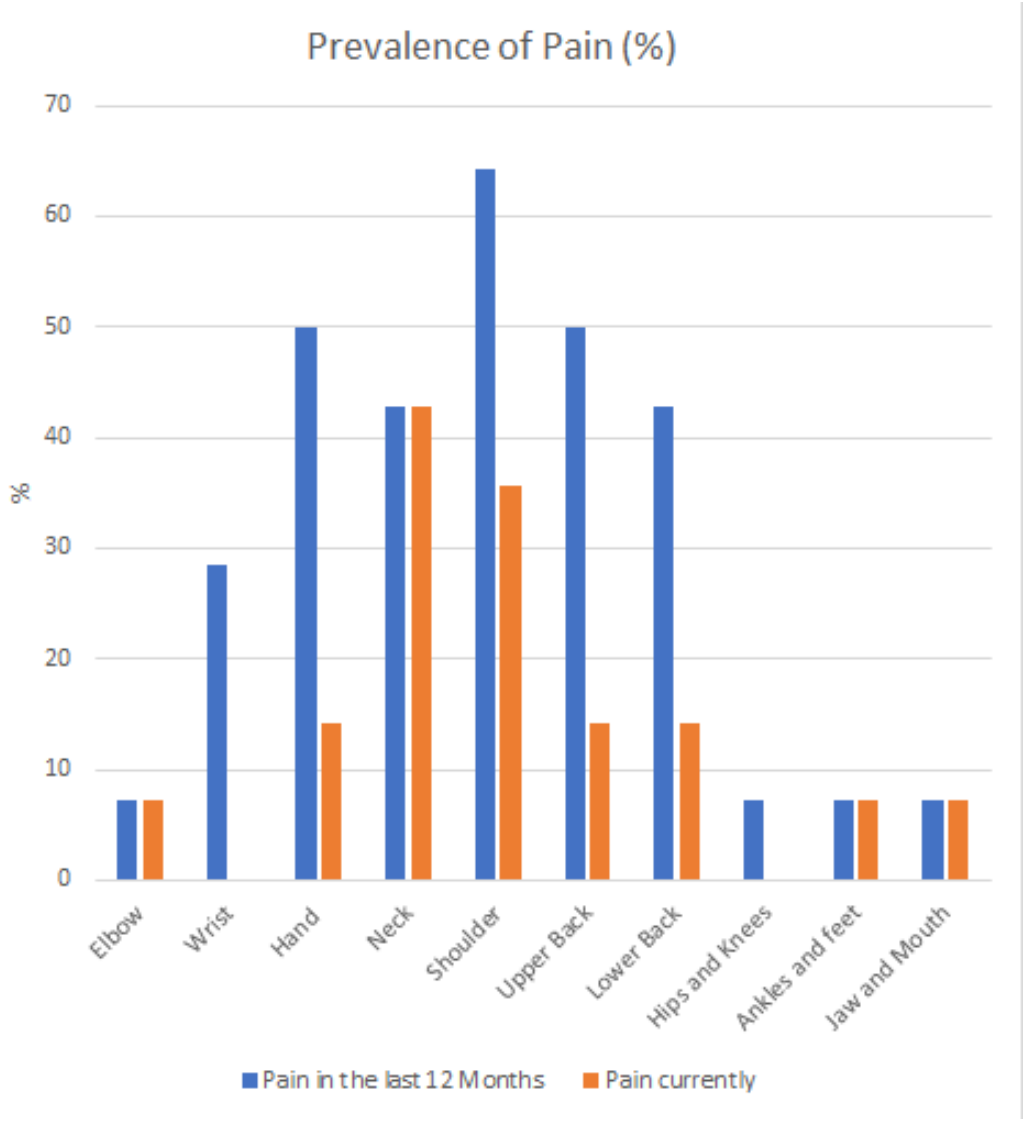


Figure 4.7: Prevalence of pain (N=14, multiple responses)

An article by Kok *et al.* (2013) shows a comparison between music students and medical students (see appendix page 120). Music students show a much higher rate of pain in the last 12 months (89.2%) than medical students (77.9%). Current pain also showed to have a much higher prevalence in music students (62.7%) compared with medical students (42.7%). Kok *et al.* (2013) state that al-

though there is very little data comparing musicians to the general population, it can be assumed that due to the ergonomically unfavourable positions that instrument playing requires, musicians will incur musculoskeletal problems.

Another aspect to consider is the willingness for the performer to admit that they have a playing-related problem. The fear of having to end their career or be less employable is a factor to consider when looking at this data (Sen, 1991).

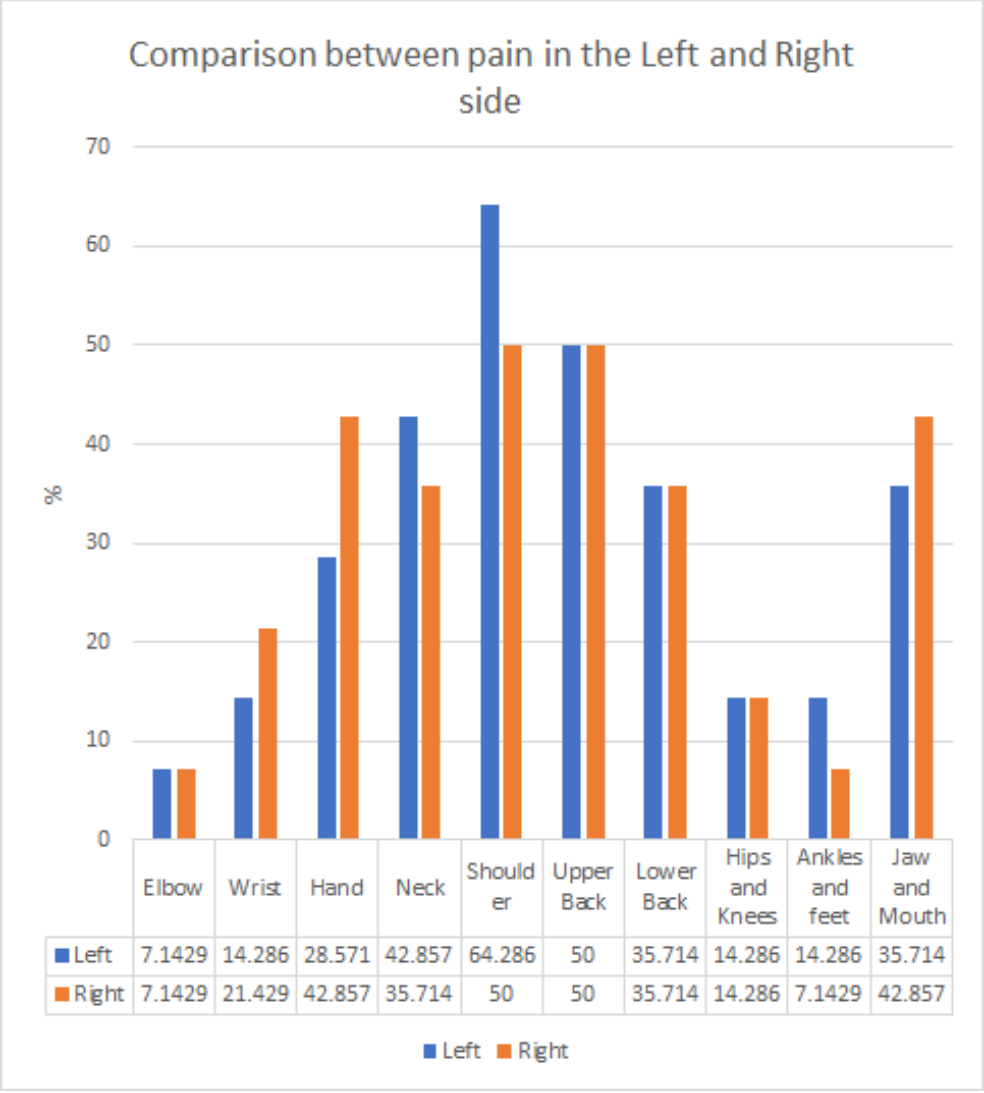


Figure 4.8: Side of pain (N=14, multiple responses)

In violin playing, the two sides of the body are responsible for different tasks. The left shoulder is used to support the violin and help move the hand into different positions. Due to the hold of the violin, constant maximum supination (inward rotation) is required. The strain on the muscles and joint in the left shoulder can lead to bursitis and tendinopathies of the shoulder. The right shoulder is more mobile, and is used to assist in bow movements. The more natural position, as well as mobility in the shoulder, reduces the rate of injuries (Moraes and Antunes, 2012).

Moraes and Antunes (2012, 47) found that the left hand was twice as likely to present problems compared to the right hand. This contrasts with the results of this study, which shows the right hand to have more problems. A number of factors could influence this outcome, including the fact that non performance-related activities (such as writing in examinations) could cause problems.

It can be seen that the highest rate of injuries occur towards the trunk of the body as opposed to the extremities. This could indicate that the problems may lie in postural problems, such as sitting incorrectly while playing (Moraes and Antunes, 2012).

The severity of the symptoms (Figure 4.9) was rated on a Likert scale from 1 - 5, with 1 being no pain and 5 being severe pain. These questions are based on the DASH questionnaire, which is used to describe the type of pain that the participant experiences.

The participant was asked to rate the severity of the symptoms in the past week. For "arm, shoulder or hand pain" and "arm, shoulder or hand pain when performing any specific activity", 3 was the most common result. This indicates a moderate amount of pain.

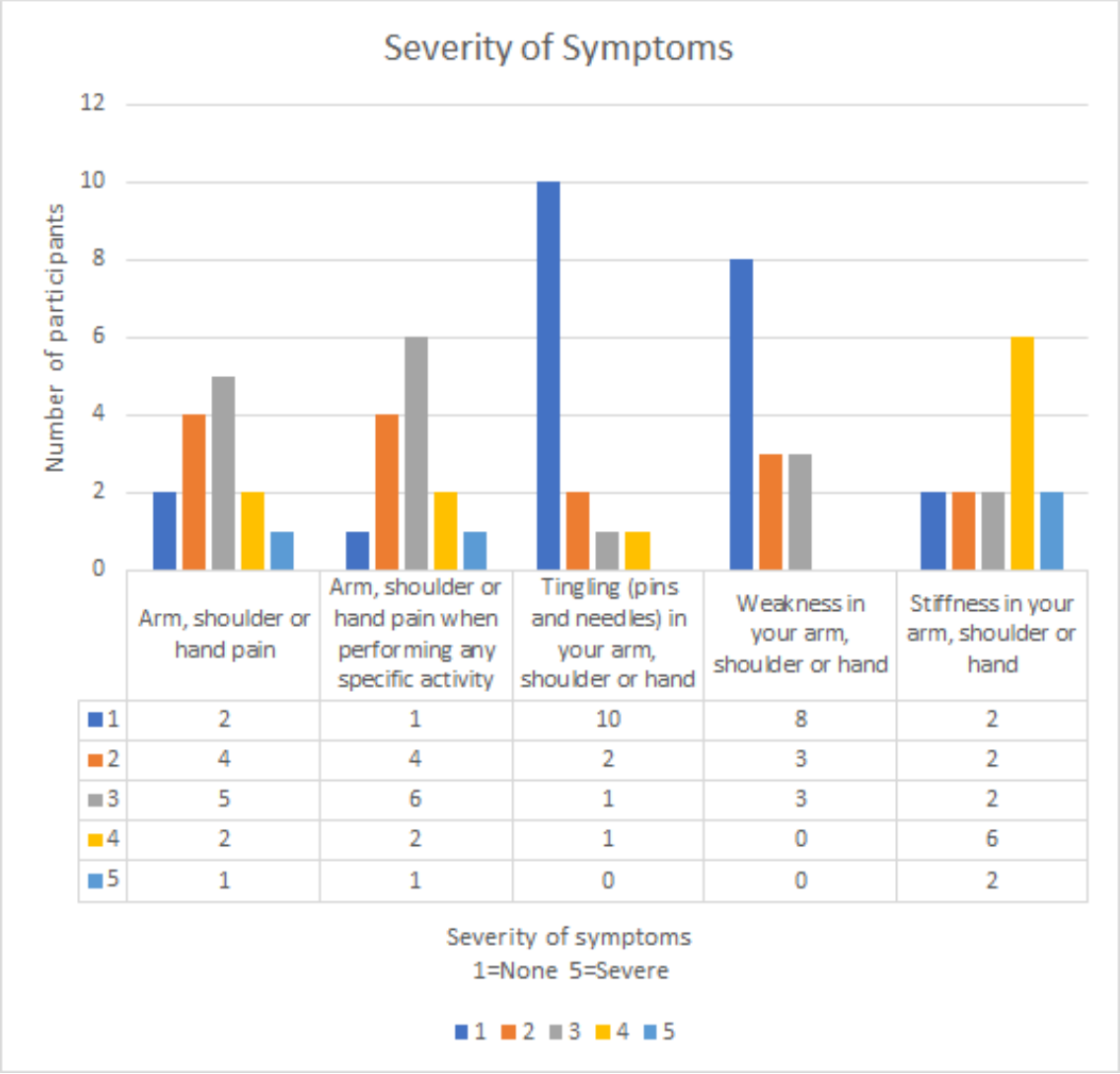


Figure 4.9: Severity of symptoms (N=14)

"Tingling (pins and needles) in your arm, shoulder and hand" is generally caused by a nerve compression somewhere in the body. This compression can be at various points between the neck and the fingers. Along with pins and needles (paresthesia), nerve compression can also create an electric shock type of feeling (Norris, 1993, 11).

The most common nerve compression is at the carpal tunnel, however, in violinists, the pronation of the left hand, especially in high positions, can lead to

ulnar nerve entrapment at the elbow (epicondilitis). Regardless of the severity of pins and needles, this symptom is worrying as it involves the nerves, and can therefore lead to weakness, and in severe cases, muscle wastage (atrophy) (Norris, 1993, 36). Four of the 14 students reported symptoms of pins and needles (28.6%). In a study by Ajidahun and Phillips (2013), one out of five (21.1%) students reported pins and needles.

Muscle weakness was reported by just under half (43%) of the participants. Half of those experiencing muscle weakness reported it as mild, and the other half reported moderate weakness. According to Edwards (1978, 465), there are several reasons as to why one may experience weakness (Figure 4.10):

1. Electro mechanical activation - This refers to the information delivered by the nerves.
2. Fuel supply - The energy that the muscle can use to perform the instruction sent by the nerve.
3. Contractile machinery - The state of the muscle (e.g., underdeveloped muscle).

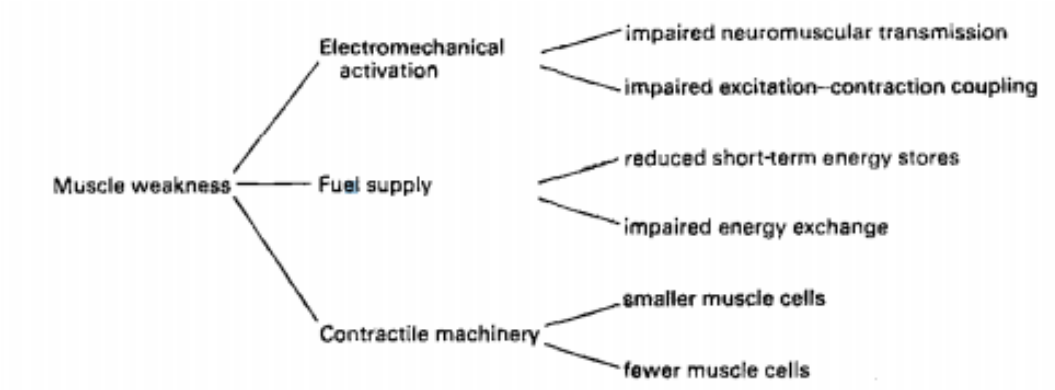


Figure 4.10: Practical scheme for analysis of muscle weakness (Edwards, 1978, 465)

When asked about "stiffness in [the] arm, shoulder or hand", the majority of the students (43%) experienced moderate to severe (4) symptoms, with only two

of the 14 students (14.2%) not experiencing stiffness in the past four weeks. This category was also responsible for the highest number of level 4 and level 5 rated symptoms.

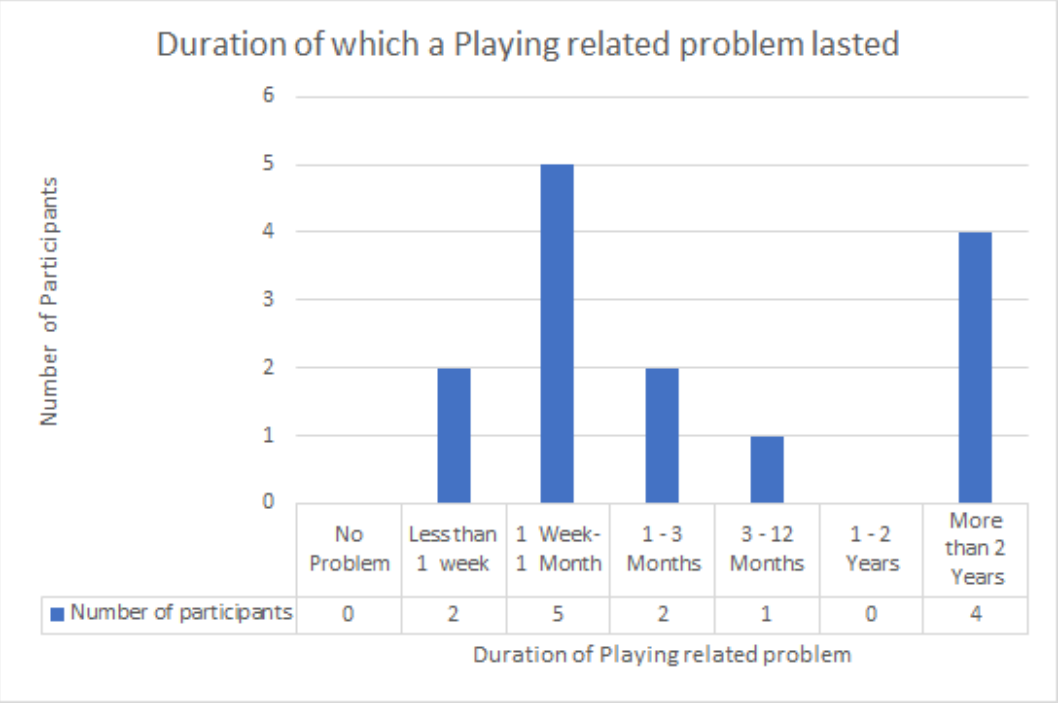


Figure 4.11: Duration of the playing-related problem (N=14)

The majority of the students (N=5) experienced problems that lasted between one week and one month. This was followed by "more than two years" (N=4) in just over a quarter (28.6%) of students. The duration of "more than two years" (28.6%) is consistent with data from Thaele (2016)[2], which stated that 19.6% of participants had problems for two years or longer.

[2]Thaele's (2016) study compared data from all instrument groups, as well as different music programmes.

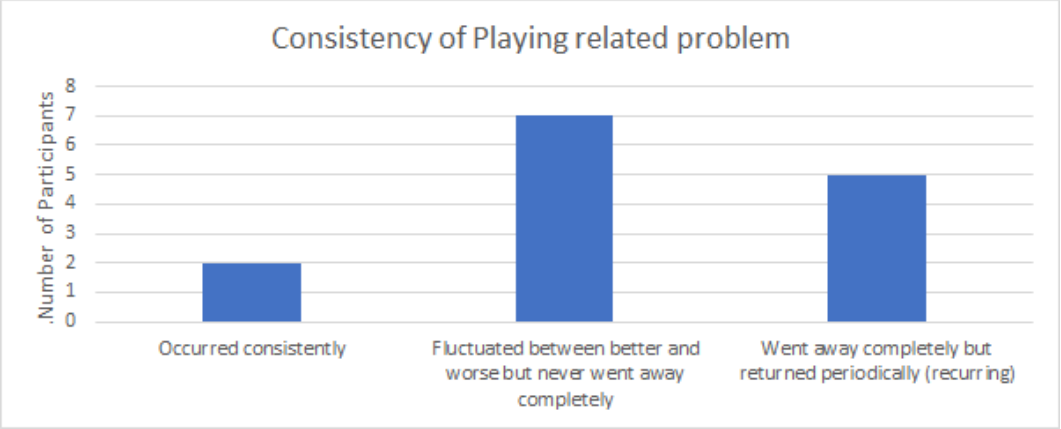


Figure 4.12: Consistency of the playing-related problem (N=14)

This data is difficult to analyse as the perception of duration may differ between students. For example, two students with exact symptoms may answer "less than one week" and "more than two years", as the one is looking at the problem in an isolated time frame, whereas the other one is considering the time in which re-occurrence took place. In Figure 4.12, the occurrence of the problems can be seen. Half of the participants experienced problems that fluctuated between better and worse but never went away completely. The best result would be if the problem went away completely, but returned periodically; however, ideally a participant would not have any problems to start with or only one occurrence of the problem before returning to a healthy state.

The impact of the playing-related problem on practice sessions (Figure 4.13) gives a good insight into the impact of injuries in musicians. Figure 4.13 is designed to show the severity of the impact on the left side of the graph (with the negative outcome increasing from bottom to top).

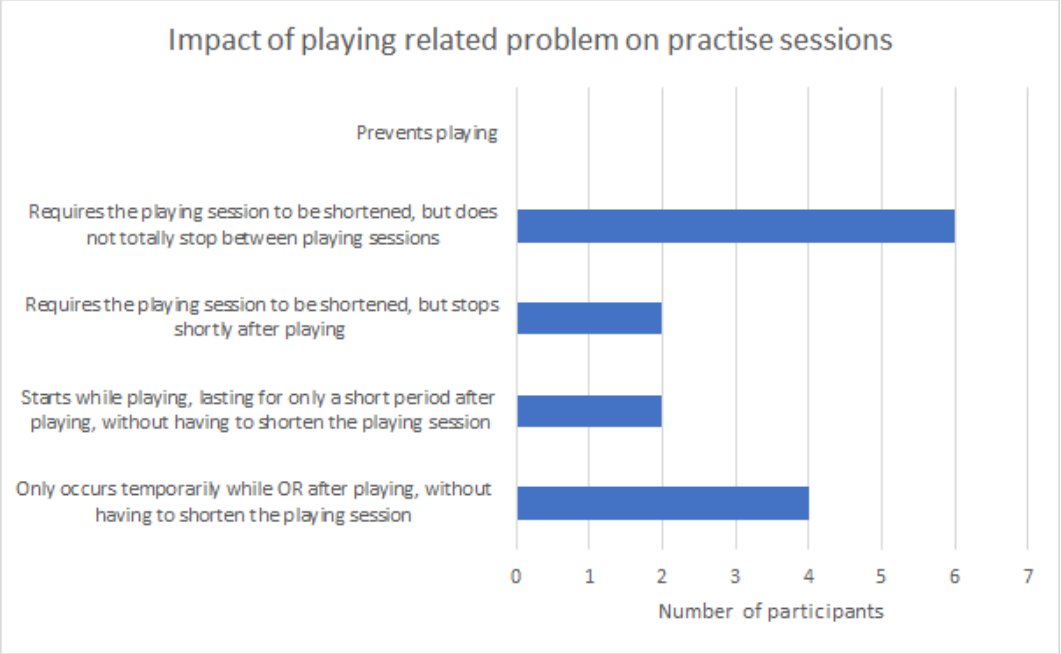


Figure 4.13: Impact of the playing-related problem on practice sessions (N=14)

The response that drew the highest result from participants was: "Requires the playing session to be shortened but does not totally stop between playing sessions". 57% of participants reported having to shorten their practice time because of their playing-related problem.

The third section of the questionnaire asked participants questions on the treatment and diagnosis of the playing-related problem. The students were given the option of selecting multiple answers (Figure 4.14).

64% of participants consulted with a health professional, with 42.9% consulting a physiotherapist. This rate is similar to that of Barnes *et al.* (2011), who found that 49% of musicians consulted a physiotherapist. The rate of 64% seeking help from health professionals can be compared to two separate studies; one by Thaele (2016, 73) who recorded this rate at 51.7% and the other by Hohls (2010, 101) at 84.2%.

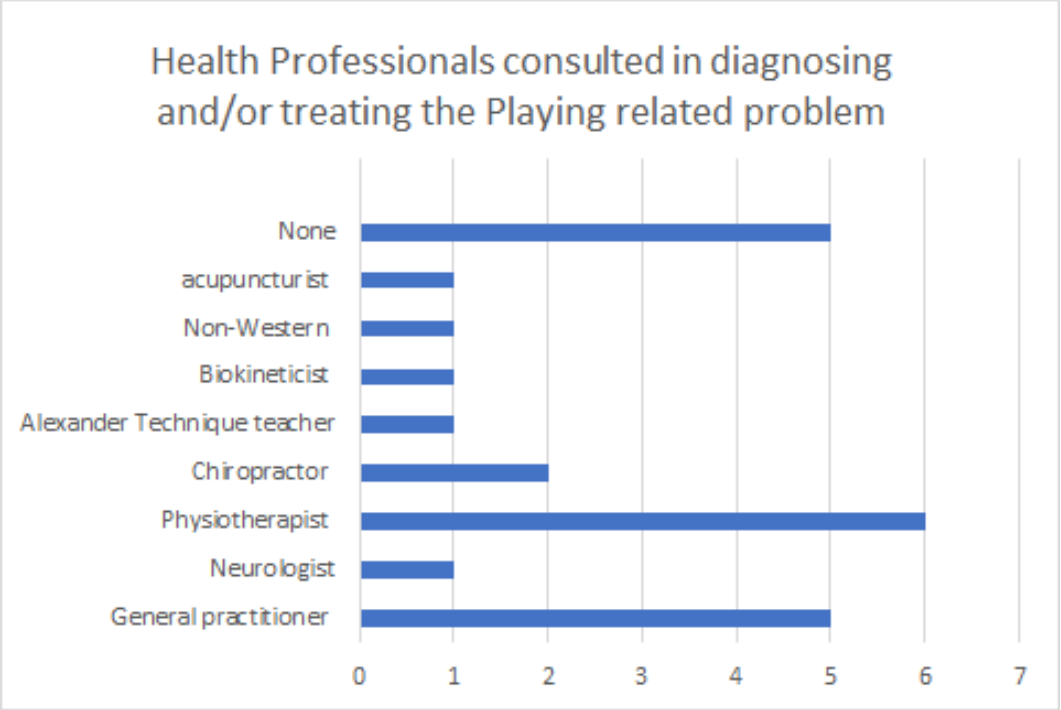


Figure 4.14: Health professionals consulted in diagnosing and/or treating the playing-related problem (N=14, multiple responses)

The ability to seek help from a health professional may not be to do with willingness so much as the financial constraints for treatment sessions. Thaele (2016) interviewed students, whereas Hohls (2010) interviewed members of professional orchestras. The participants of Hohls (2010) study were earning salaries and were therefore able to pay for treatment.

In this study, around one out of three (36%) students consulted a general practitioner. According to Health careers-NHS Online (2018), a general practitioner is usually the first point of contact for people with a physical or mental health problem. Appointments are generally scheduled for 10 minutes in which the doctor will assess the patient's symptoms, take a short medical history, and devise a treatment plan. Treatment may include oral anti-inflammatory medication, splinting, rest, etc., or a referral to a specialist; however, without a more in-depth knowledge of performing-arts medicine, the treatment may not be tailored enough for a musician. A general practitioner may not be the most appropriate

professional for a musician to see (Watson, 2016, 14), however, many people understand a general practitioner to be the correct starting point for treatment of an injury.

Although all of the participants in this study had experienced pain in the last 12 months, just over one third (36%) did not seek any treatment from a health professional. With reference to Figure 4.15, zero students reported doing "nothing" to treat playing-related problems, which means that even though the students did not consult a health professional, they still treated it themselves.

One participant consulted with a neurologist[3]. In the case where nerves are involved, with pins and needles or numbness in the extremities (Figure 4.9), a neurologist would be the appropriate specialist to see.

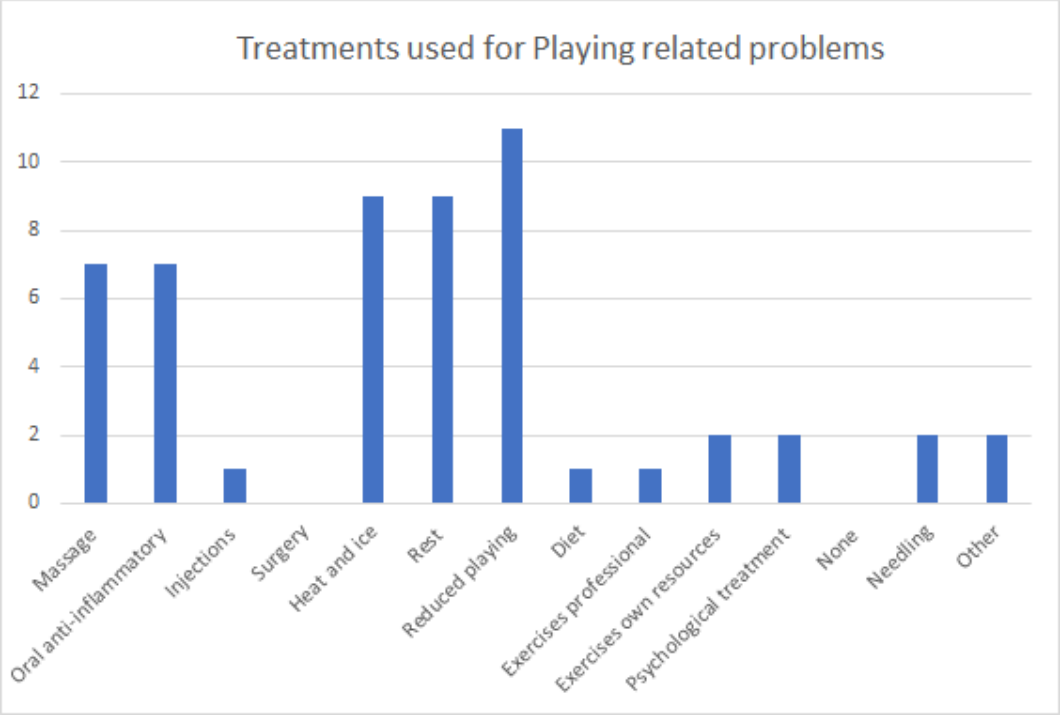


Figure 4.15: Treatments used for playing-related problems (N=14, multiple responses)

[3]Neurologists specialise in treating diseases that affect the brain, spinal cord, and peripheral nervous system. They are trained to perform nerve conduction studies and assess the severity and treatment of nerve disorders (Study.com, 2018).

In Figure 4.15, "reduced playing" refers to shortening playing sessions on a daily basis, whereas "rest" refers to a treatment plan where playing or practising is suspended completely for a certain amount of time (from days to weeks). Although rest is shown to be the most effective treatment for overuse injuries (Fry, 1986), this is not always feasible for students who need to practise almost daily for lessons, concerts, and examinations.

The use of massage (used by 50% of the participants) shows positive outcomes. Brummitt (2008) defines two uses of massage in sports performance and compares results from different studies in each of the categories:

- Massage used prior to injury to help performance.
- Massage used for recovery after exercise.

Results of massage prior to injury showed:

- Less shoulder, neck, and back pain, as well as improved neck extension and shoulder abduction (Leivadi *et al.*, 1999).
- The perceived intensity of pain was less after a massage prior to activity (Hilbert *et al.*, 2003; Mancinelli *et al.*, 2006; Hemmings *et al.*, 2000; Monedero and Donne, 2000).

The effect of post-exercise massage yielded less conclusive findings, with some studies reporting better recovery (Hemmings *et al.*, 2000) and other studies showing no significant improvement (Dolgener and Morien, 1993; Tiidus, 1997; Shoemaker *et al.*, 1997; Jönhagen *et al.*, 2004).

Heat and ice therapy was highly reported, with 64% of participants using this treatment. Heat is used to soothe painful muscles and stiff joints by increasing circulation (thereby aiding healing) to the area. Ice therapy, otherwise known as cryotherapy, has the opposite effect by reducing blood flow (Bleakley *et al.*, 2012),

which minimises inflammation and swelling.

Four of the five main treatments (heat and ice, anti-inflammatories, rest, and reduced playing) are treatments that can be used without the help of a medical professional. Winspur and Warrington (2010) ascribe the mistrust that some musicians feel towards doctors to their lack of knowledge of performance injuries. Solutions to the problem could be to be to provide students with tools to help treat themselves, information about the correct medical professional to seek help from, or to give easily accessible information to medical professionals for the treatment of musicians.

No students had needed surgical intervention. The results of this study correlate to the study by Thaele (2016, 74), with rest and reduced playing being two of the top treatment options.

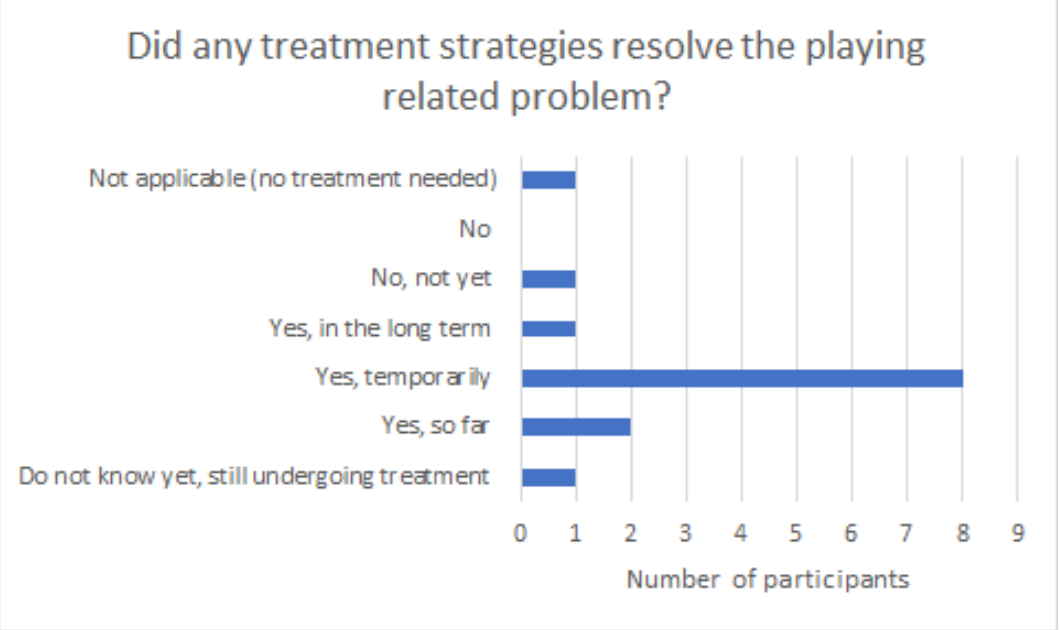


Figure 4.16: Effectiveness of treatment strategies (N=14)

Figure 4.16 shows the perceived effectiveness of treatments. The answer "yes, temporarily" was the statement that most participants answered, with 57% of

students choosing this option. Thaele (2016) found similarly that 45.3% of students answered "yes, temporarily". The most ideal treatment outcome would be "yes, in the long-term". "Yes, in the long-term" suggests that the treatment was effective over a long period of time and not just a short-term solution to the problem. Only one participant (7.1%) agreed that the treatment had helped in the long term. Thaele (2016, 184) reported a similar trend, with only 5.7% of participants believing the treatment helped in the long-term. The high rate of "yes, temporarily" could indicate that either proper treatment is not being used, or that students do not have knowledge/do not apply prevention techniques.

A discrepancy can be seen when comparing Figure 4.15 to Figure 4.16. 100% of participants used some type of treatment for their playing-related problem; however, one participant stated that there was no treatment needed for their playing-related problem (Figure 4.16).

4.2 Availability of information at institutions

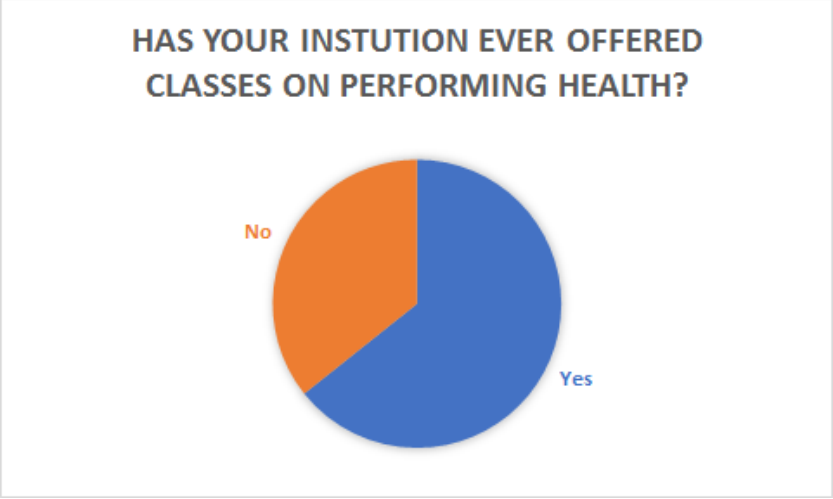


Figure 4.17: Institutions offering classes on performing-arts health (N=14)

Just under two thirds (64.3%) of students reported that their institution offered some type of class on performing-arts health (Figure 4.17).

	Frequency
No	5
Yes	9

5	Alexander Technique
1	Body mapping
1	Teaching methods class
1	Musician's health Class
1	Physiotherapist talk

The majority of classes offered was the Alexander Technique, with just over one out of three (36%) students having access to Alexander Technique classes.

For "teaching methods class" and "musician's health class", both students reported that it was one single class with a brief overview of musician's health. The "physiotherapist talk" was reported to be more of an advertisement talk rather than providing information to the students that they could actually use.

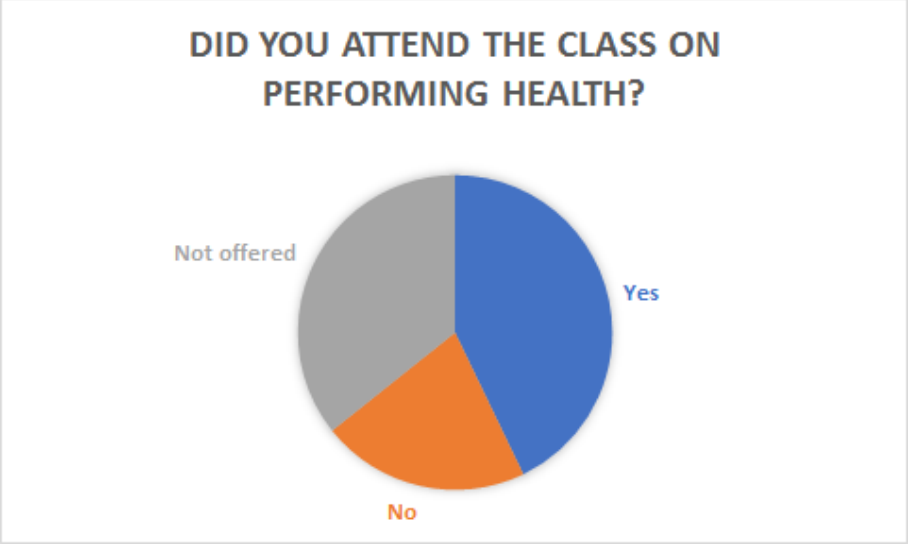


Figure 4.18: Attendance of performing-arts health classes (N=14)

Two out of three (67%) students attended classes on performance-related health. Ideally, the attendance rate should be higher. The rate of attendance does not necessarily correlate to the students being uninterested. Some of the

classes required payment, which excluded participants who were unable to pay. Basic performing-arts knowledge should not only be available to students who are able to pay.

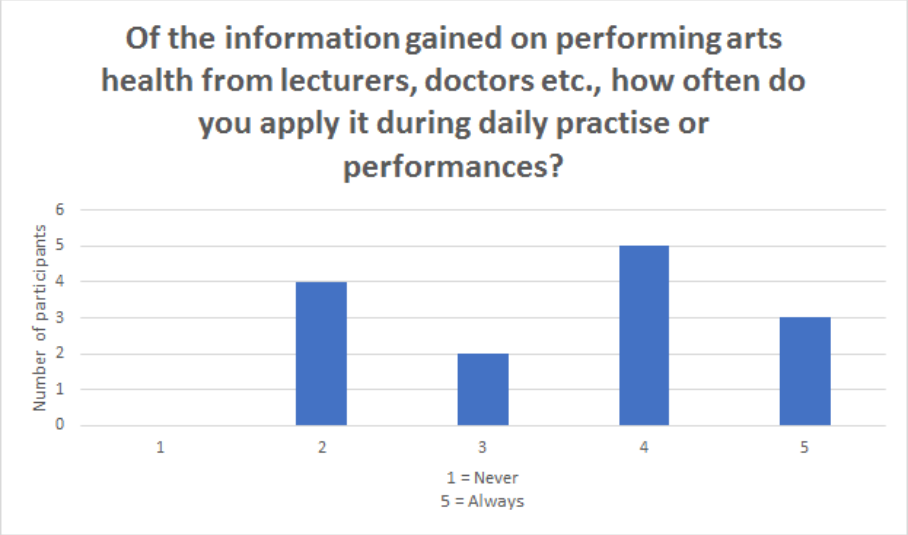


Figure 4.19: Frequency of application of knowledge gained on performing-arts health (N=14)

The application of knowledge was rated in terms of how often students applied their knowledge in daily practice or performance (Figure 4.19). The average answer given was 3.5 (on a scale from 1 - 5), which is not particularly high. Although the results could be interpreted as a lack of willingness to use information, it could also be that the students did not feel that the information they received was helpful. Students did however feel very strongly that it was important for institutions to make resources available on performing-arts health (Figure 4.20). The majority of students (N=12) rated importance at 5 (the highest level of importance), and the remaining (N=2) students rated a 4 for importance.

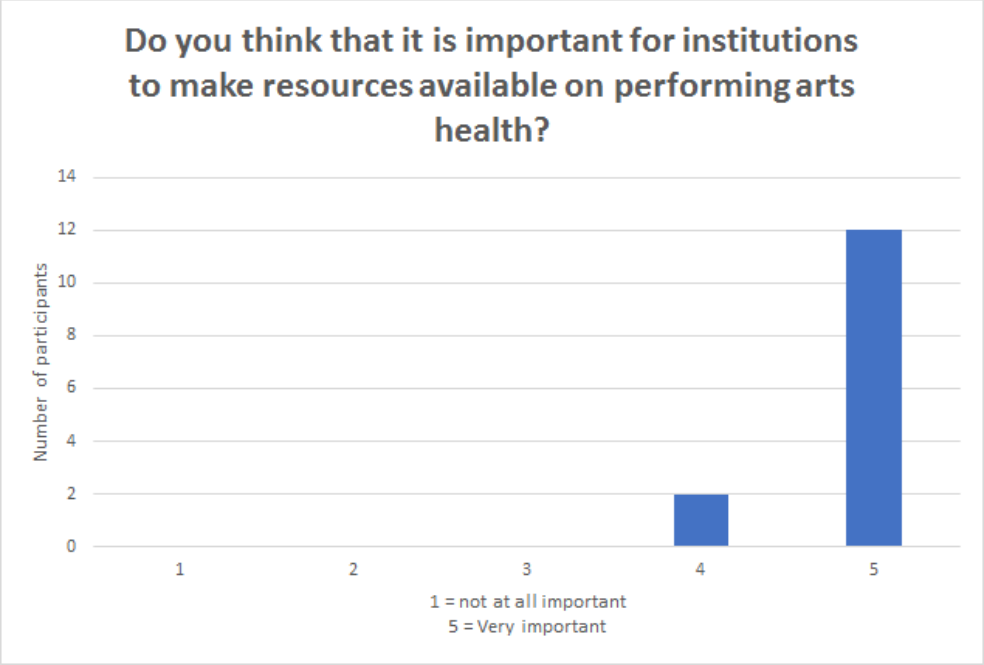


Figure 4.20: Perception of importance of performing-arts health classes and resources (N=14)

For the final question, students were asked to make suggestions on what they would hypothetically like to see be put in place by institutions. Some of these suggestions would not be financially viable, however, they will still be mentioned:

- Participant 1: A class about physiotherapy, and how to avoid injuries, as well as the employment of a physiotherapist at the school of music.
- Participant 2: Raised awareness and a re-evaluation of the workload and curriculum. Access to practitioners and a class dedicated to stretching, Alexander Technique, etc., would be beneficial.
- Participant 3: No answer.
- Participant 4: Mental health programmes and physiotherapy programmes.
- Participant 5: Alexander Technique and physiotherapy.
- Participant 6: Something which allows for the understanding of how our muscles and joints work while playing in order to avoid injuries altogether.

- Participant 7: More information sessions given on a regular basis about keeping general health, and movement of a musician. Preventative practices instead of what to do AFTER developing an injury.
- Participant 8: Alexander Technique, advice or availability of physiotherapists, raised awareness of injuries, and how to treat and/or prevent them.
- Participant 9: A short course worked into the degree with body movement or yoga, and body mapping.
- Participant 10: Performing-arts health courses or classes.
- Participant 11: A semester module in first year on performing-arts health.
- Participant 12: Alexander Technique classes. Lectures on general posture and how to identify tension, as well as accessibility to a physiotherapist who is knowledgeable on violin playing injuries.
- Participant 13: A short course given by a physiotherapist who is also a musician. Or a course where a physiotherapist and musician collaborate to give a class.
- Participant 14: A regular class on proper technique to avoid injuries.

Chapter 5

Recommendations and conclusion

Based on the findings and discussion, as well as literature discussed, a number of recommendations can be made to institutions, students, and teachers. These recommendations are not meant to be mutually exclusive, but rather encourage institutions, learners, and teachers to work together to reduce the number of performance-related problems.

5.1 Recommendations for institutions

Internationally, a move towards increasing education on performing-arts injuries at universities has taken place, with some institutions offering occupational health courses (Clark and Lisboa, 2013). Students at the Hannover University of Music and Drama in Germany have to attend a compulsory physiology course. There are also optional consultations with specialists, free of charge (Rennie-Salonen and de Villiers, 2016). Access to classes has shown to reduce frequency of injuries by up to 78% (López and Martínez, 2013, 102).

López and Martínez (2013) state that the most important information for students is to know how to prevent injuries and early detection.

Budgetary concerns may present an issue to institutions during strained economic times. Group classes are a good way of ensuring that many students benefit from specialist knowledge.

A physiotherapist (or other relevant health professional) could be asked to give a lecture to a large group, as opposed to one-on-one classes. In the lecture, the physiotherapist could educate the learners at what point to seek medical help.

The physiotherapist could also teach more practical activities like stretching and warming up exercises.

5.2 Recommendations for learners

There are different ways, as found in Chapter 4, that learners can help themselves in preventing, managing, and treating playing-related problems. There is a clear willingness to learn more about playing-related problems; however, the information gained is wasted if students do not apply the knowledge in daily practice sessions and performances (Figure 4.19). Students should try their best to make healthy playing a habit and not to defer responsibility to institutions, teachers, and health professionals. Below are a number of ways that students can take control of their own performing health.

Guptill and Zaza (2010, 29) state that many injuries are caused by behavioural factors that can be fixed with modification. Some techniques that can be implemented in the practice room are:

- Stretching: Stretching is one of the simplest ways reduce the risk of injuries, as well as reduce pain. A few stretches (see Figure 1.1- Chapter 1) at ten-minute intervals during a practice session is recommended (Cooper *et al.*, 2012).

- Warm ups: Warm up should consist of 'easy' technical exercises as advised by the teacher. Nothing strenuous should be performed first. A good idea is to start with scales and arpeggios. Guptill and Zaza (2010, 29) also advise

that some stretching of the neck, back and upper limbs be done, but not so much as to hurt the musician.

- Breaks: Short breaks from practising can help the muscles to relax. This could include putting down one's instrument and practising mentally instead. López and Martínez (2013, 102) showed that the practice times significantly changed the rate of injuries. Students who practised for 81 minutes at a time showed a significantly higher rate of injuries compared to students who practised for 56 minutes at a time. Breaks between practice sessions should range between 5 and 15 minutes.

- Pacing: Pacing refers to the amount of practising that one does over a certain period of time. Guptill and Zaza (2010, 31) state that to help avoid injuries, students should not cram an intense practice session in before their lessons, nor should they drastically increase practice time. Guptill and Zaza (2010) suggest that students keep a practice log of their practice time and gradually increase the amount practised each day.

- Posture:
  - A natural position of the spine should be maintained, and movement, rather than a static playing position should be encouraged.
  - When sitting, weight should be distributed between the buttocks and the feet, while making sure that one does not slouch or 'overextend' the arch in the back.
  - It is of utmost importance that the seat is flat. A seat should either be parallel to the ground or leaning slightly forward (but no more than 20 degrees) (Guptill and Zaza, 2010, 31).
  - When standing, the most common mistake is locking the knees. By unlocking the knees, the body's joints can move freely. The feet should be placed shoulder length apart, with the shoulders relaxed, and the chin not protruded.

- Technique and tension: It is no surprise that tension can be a risk factor for injury. Guptill and Zaza (2010, 31) believe that attempting something where the technical requirements are too high will lead to unnecessary tension. Teachers should also be aware of typical points of tension, such as the left shoulder in violinists. Like the warm-ups that were discussed, cooling down exercises can also be used to reduce tension. This includes upper limb stretches after practising.

- Repetition: Although repetition is an important part of practising, it is also a risk factor for injury. There are several ways the musicians can get the same results from repetition in a more efficient way. Firstly, smart practising can help the student work methodically and properly when learning a new work. In smart practising, the musician does not play from the beginning of the piece to the end regardless of mistakes. Smaller sections of music are worked on till perfection, starting slowly and getting faster without compromising the technique or sound (Guptill and Zaza, 2010, 31).

- Mental (cognitive) practising can also be used to maximise the outcome of a practice session. During mental practising, the musician is away from their instrument most of the time. This may include visualising the performance of a work, working out the fingerings on a piece of paper, and listening to a recording while looking at the music (Guptill and Zaza, 2010, 31). Although Guptill and Zaza (2010) do not discuss much about mental practice, there is a lot of literature that can be found on the topic.

5.3 Recommendations for teachers

Guptill and Zaza (2010, 32) state that teachers are very important in helping with injuries as they are usually the first to discuss them with their students. Teachers should not try to diagnose the injury themselves but should rather know the correct steps that the student should take when an injury occurs. This in-

cludes educating oneself on the proper course to take, such as seeking medical attention from a professional.

Guptill and Zaza (2010) state that teachers should not dismiss pain, numbness and tingling, uncoordinated movements, or bumps as these are all signs of possible injury. Instead of dismissing pain, teachers should be at the forefront of promoting wellness and sustainable practice. Interdisciplinary collaboration should be used by both the teacher and the institutions. It is not only the learners' responsibility to educate themselves on performance-related problems, prevention, and treatment but also the educator's. The educator has a vital role in helping the learner. According to Palac (2016, 20):

> Music teachers in the field-who have the most direct influence on music students-must have access to music health information and easily implemented strategies for health promotion.

Palac (2016) states that even though the educator should gain as much knowledge as possible, they are not qualified to diagnose problems, and should therefore create a trusted network of professionals to help them and their students.

5.4 Conclusion

According to Barnes *et al.* (2011), the rate of performance-related injuries in South Africa is higher than the international standards. Data collected for this study suggests that BMus students with violin as a main instrument suffer from an even higher rate of upper limb injuries compared the rest of South African classical instrumentalists.

Education and a hands-on approach to dealing with performance-related injuries are some of the most effective ways to combat performance-related injuries (HPSM, 2009). Although students feel strongly that it is important for institutions to provide resources on performing-arts health, the application of knowledge by students is not particularly high (Figure 4.19). While institutions and

educators should increase the availability of resources, learners need to take responsibility for applying the knowledge and making use of the resources provided (Figure 4.18).

With all three levels (learners, teachers, and institutions) working together towards improved performing-arts health, the rate and impact of playing-related problems has the ability to be dramatically reduced. From the results of the study, it can be seen that even though students often have information, they do not always apply this information. Students should make a conscientious effort to apply information. Teachers should attempt to create an environment where students can talk about pain and injuries. Teachers could strive to learn more about instrument specific injuries and ways to help their students. Institution should attempt to provide more performing health classes and create a system where information on injuries is easily accessible.

A recommendation for further studies would be to have more open-ended questions where qualitative information can be collected. It would also be useful for further studies to look at music educators for university violinists, and assess their knowledge and the recommendations that they give to their learners.

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Appendix

The appendix includes information that is relevant to the thesis but was not included in the main section of the thesis. Below is a list of what is being shows in the appendix.

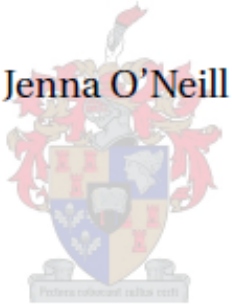
1. The questionnaire used for the collection of data
2. The blank permission form for the head of departments. Head of the string departments from The University of Cape town and NMMU signed on behalf of the HODs.
3. Permission from The University of Stellenbosch
4. Permission from the University of Cape Town
5. Permission from the University of Pretoria
6. Permission from NMMU
7. Ethical clearance form given to participants
8. Ethical clearance from the Research ethics committee- University of Stellenbosch
9. Ethical clearance from the Research ethics committee (issued to Dr Kohler, the original supervisor for this thesis) from Nelson Mandela University.
10. Ethical clearance from the Research ethics committee (updated with Dr Martens) from Nelson Mandela University.

11. Musculoskeletal complaints during the last 12 months among music academy students and medical students specified by location (Kok et al., 2013)

What is the extent of knowledge of performance related injuries among BMus violin students in South Africa, and to what extent is this knowledge translated into prevention and help-seeking behaviour/treatment?

by

Jenna O'Neill



Questionnaire

17493684@sun.ac.za

Supervisor: Dr. H. S. Martens

martens@sun.ac.za

Questionnaire

This questionnaire has been designed to better understand the rate of injuries among South African violin students. In completing this questionnaire, you will be providing invaluable information for my Masters thesis. I will begin by asking general questions and then move on to more detailed questions on injuries to compare statistics with international data.

Please note that your answers will be completely confidential. If you have any questions at all, please feel free to ask me. You may at any point refrain from completing the questionnaire.

General Information

Age	
Gender	
Institution	
Course	
Year (3rd, 4th or graduated last year)	
Main instrument	
Hours spent practising main instrument (daily)	
Second instrument	

Prevalence of injuries

This section aims to evaluate the prevalence of injuries at different points in the body.

Please mark using an "x" in the relevant column and indicate whether the pain occurred on the left or right side of the body.

	Pain in the last 12 months	Pain currently	Left or right side
Elbow			
Wrist			
Hand			
Neck			
Shoulder			
Upper Back			
Lower back			
Hips and knees			
Ankles and Feet			
Jaw and Mouth			

	1 not at all	2	3	4	5 extremely
During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups					
During the past week, to what extent has your arm, shoulder or hand problem interfered with your work or other regular daily activities					
During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand					
I feel less capable, less confident or less useful because of my arm, shoulder and hand problem					

Please rate the severity of the following symptoms in the last week.

Please mark using an "x" in the relevant column.

	1 None				Severe
Arm shoulder or hand pain					
Arm shoulder or hand pain when performing any specific activity					
Tingling (pins and needles) in your arm shoulder or hand					
Weakness in your arm shoulder or hand					
Stiffness in your arm shoulder or hand					

How long did the playing-related problem last?

Please mark using an "x" in the relevant column

No problem	
Less than 1 week	
1 week – 1 month	
1 – 3 months	
3 – 12 months	
1 – 2 years	
More than 2 years	

Each time you played your instrument during the time indicated above, the playing-related problem:

Please mark using an "x" in the relevant column or leave blank if not applicable

Occurred consistently;	
Fluctuated between better and worse but never went away completely;	
Went away completely but returned periodically (recurring).	

With reference to the previous question, please indicate how the playing-related problem affected practising or performing.

Please mark using an "x" in the relevant column or leave blank if not applicable

Only occurs temporarily while OR after playing, without having to shorten the playing session;	
Starts while playing, lasting for only a short period after playing, without having to shorten the playing session;	
Requires the playing session to be shortened, but stops shortly after playing;	
Requires the playing session to be shortened, but does not totally stop between playing sessions;	
Prevents playing.	

In diagnosing and treating your playing-related problem, which health professional(s), if any, did you consult?

Please mark using an "x" in the relevant column(s)

General practitioner		
Specialist (neurologist, orthopaedic etc.) *Please specify*		
Physiotherapist		
Occupational therapist		
Chiropractor		
Alexander teacher		
Feldenkrais teacher		
Body mapping specialist		
Sport scientist		
Biokineticist		
Psychologist		
Non-western		
Dietician		
Other *Please specify*		
None		

Which of these treatments strategies did you make use of?

Please mark using an "x" in the relevant column(s)

Massage		
Oral anti-inflammatory		
Injections		
Surgery ***Please specify***		
Heat and ice		
Rest		
Reduced playing		
Diet		
Exercises professional		
Exercises own resources		
Psychological treatment		
None		
Other treatment ***Please specify***		

Did any of the treatment strategies resolve the playing-related problem(s)

Please mark using an "x" in the relevant column

Do not know yet, still undergoing treatment	
Yes, so far	
Yes, temporarily	
Yes, in the long term	
No, not yet	
No	
Not applicable (no treatment needed)	

Has your institution ever offered classes on performing health? (i.e. Alexander techniques classes, lectures by health professionals etc.)

Yes ***Please specify***		
No		

Did you attend?

Yes	
No	

	1- never	2	3	4	5 always
Of the information gained on performing arts health from lecturers, doctors etc., how often do you apply it during daily practise or performances.					

	1 Not at all important	2	3	4	5 Extremely important
Do you think that it is important for institutions to make rescores available on performing arts health?					

What programs would you like to see be put in place?

Permission from head of department

This updated letter serves as a permission statement from the head of department/ head of strings.

If you are willing to allow interviews to be done in your department and for me to contact the administrative staff to access contact details of the students to who this may apply, please sign below.

I will follow up with the relevant administrative staff to access contact details.

I have attached my covering letter, for if more information is needed.

_____ _____

Name Signature

_____

Institution

Jenna O'Neill
MMus - Stellenbosch University

0849236167 | 17493684@sun.ac.za

Supervisor: Suzanne Martens

martens@sun.ac.za

20 March 2018
To whom it may concern:

I am currently conducting research for my master thesis titled "What is the extent of knowledge of performance related injuries among BMus violin students in South Africa, and to what extent is this knowledge translated into prevention and help-seeking behavior/treatment".

To conduct this study, I need permission from your institution to access student contact details and interview them.

Students who will need to be contacted will be:

- Third year violin students specializing in performance
- Forth year violin students specializing in performance
- Students who in 2017 were specializing in violin performance and have now graduated

I would be extremely grateful for this permission- as well a list of the students. Please could you forward the email to the person in charge of student admin, or send me their email and I will contact them directly to access student information.

Sincerely,

Jenna O'Neill

Permission from head of department

This updated letter serves as a permission statement from the head of department/ head of strings.

If you are willing to allow interviews to be done in your department and for me to contact the administrative staff to access contact details of the students to who this may apply, please sign below.

I will follow up with the relevant administrative staff to access contact details.

I have attached my covering letter, for if more information is needed.

Pieter Grobler
Name


Signature

Stellenboch Universiy Department of Music
Institution

Permission from head of department

This updated letter serves as a permission statement from the head of department/ head of strings.

If you are willing to allow interviews to be done in your department and for me to contact the administrative staff to access contact details of the students to who this may apply, please sign below.

I will follow up with the relevant administrative staff to access contact details.

I have attached my covering letter, for if more information is needed.

Farida Bacharova
Name

Signature

South African College of Music University of Cape Town
Institution

Permission from head of department

This updated letter serves as a permission statement from the head of department/ head of strings.

If you are willing to allow interviews to be done in your department and for me to contact the administrative staff to access contact details of the students to who this may apply, please sign below.

I will follow up with the relevant administrative staff to access contact details.

I have attached my covering letter, for if more information is needed.

15. April 2016
Name

Signature

University of Pretoria
Institution

Permission from head of department

This updated letter serves as a permission statement from the head of department/ head of strings.

If you are willing to allow interviews to be done in your department and for me to contact the administrative staff to access contact details of the students to who this may apply, please sign below.

I will follow up with the relevant administrative staff to access contact details.

I have attached my covering letter, for if more information is needed.

DAVID BESTER
Name

Signature

Nelson Mandela University
Institution

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STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH

Dear Fellow student

My name is Jenna O'Neill and I am currently working on my Masters of Music degree. I would like to invite you to participate in a research project entitled "What is the extent of knowledge of performance related injuries among BMus violin students in South Africa, and to what extent is this knowledge translated into prevention and help-seeking behaviour/treatment?"

Please take some time to read the information presented here, which will explain the details of this project and contact me if you require further explanation or clarification of any aspect of the study. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

Through this survey, I hope to gain more information on injuries among violin students at South African universities. I have found that many violin students incur injuries due to demanding practise schedules, rehearsals and performances. When an injury occurs, many students do not have support and do not know what path to follow to regain physical health. Your participation will enable me to gather more information on the rate of injuries and treatment programs.

- Information received from this survey will remain **completely** confidential and anonymous. I will personally conduct any interviews and all electronic surveys will come to me directly. Recordings of phone interviews (which will require the participant's identity) will be stored on my personal computer and will only be allowed to be accessed by personnel from the ethics committee.
- I hope that the outcomes of this thesis will eventually allow for performance health classes to be offered to students and teachers.
- I hope that the data will reveal more information on injuries thereby eliminating stigma associated with performance related injuries.
- You are welcome to withdraw from participating in the study or omit answers that you are not comfortable answering.
- I am not qualified to diagnose any condition; however, I shall try my best to help point you in the correct direction of a professional.

If you have any questions or concerns about the research, please feel free to contact me at 17493684@sun.ac.za or on 0849236167. Alternatively, you may contact my supervisor, Dr Martens at martens@sun.ac.za.

RIGHTS OF RESEARCH PARTICIPANTS: You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research participant, contact Mrs. Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development. You have right to receive a copy of the Information and Consent form.

If you are willing to participate in this study please sign the attached Declaration of Consent and email me your survey along with your consent form or hand it to me directly.

DECLARATION BY PARTICIPANT

By signing below, I …….. agree to take part in a research study entitled "*What is the extent of knowledge of performance related injuries among BMus violin students in South Africa, and to what extent is this knowledge translated into prevention and help-seeking behaviour/treatment*? " and conducted by Jenna O'Neill.

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

Signed on ……..

……

Signature of participant

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the participant].* [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [*Afrikaans/*English/*Xhosa/*Other*] and [*no translator was used/this conversation was translated into* _____ by _____].

_____ _____

Signature of Investigator **Date**

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

APPROVED WITH STIPULATIONS
REC Humanities New Application Form

6 April 2018

Project number: MUS-2018-0254

Project title: Jenna O'Neill Thesis

Dear Miss Jenna O'Neill

Your REC Humanities New Application Form submitted on **26 March 2018** was reviewed by the REC: Humanities on and approved with stipulations.

Ethics approval period:

Protocol approval date (Humanities)	Protocol expiration date (Humanities)
06 April 2018	05 April 2021

REC STIPULATIONS:

The researcher may proceed with the envisaged research provided that the following stipulations, relevant to the approval of the project are adhered to or addressed:

The researcher is requested to upload the various permission letters once she has received them. **[Response Required]**

HOW TO RESPOND:

Some of these stipulations may require your response. Where a response is required, you must respond to the REC within **six (6)** months of the date of this letter. Your approval would expire automatically should your response not be received by the REC within 6 months of the date of this letter.

Your response (and all changes requested) must be done directly on the electronic application form on the Infonetica system:https://applyethics.sun.ac.za/Project/Index/292

Where revision to supporting documents is required, please ensure that you replace all outdated documents on your application form with the revised versions. Please respond to the stipulations in a separate cover letter titled "**Response to REC stipulations**" and attach the cover letter in the section **Additional Information and Documents**.

Please take note of the General Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

If the researcher deviates in any way from the proposal approved by the REC: Humanities, the researcher must notify the REC of these changes.

Please use your SU project number (MUS-2018-0254) on any documents or correspondence with the REC concerning your project.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

FOR CONTINUATION OF PROJECTS AFTER REC APPROVAL PERIOD

Please note that a progress report should be submitted to the Research Ethics Committee: Humanities before the approval period has expired if a continuation of ethics approval is required. The Committee will then consider the continuation of the project for a further year (if necessary)

Included Documents:

Document Type	File Name	Date	Version
Research Protocol/Proposal	thesis-2017-april (3)	31/08/2017	1
Informed Consent Form	Consent document	14/03/2018	1
Informed Consent Form	consent form electronic	14/03/2018	1
Informed Consent Form	verbal consent	14/03/2018	1
Data collection tool	Questions 28feb	14/03/2018	1
Data collection tool	Questions 28feb	14/03/2018	1
Request for permission	gate keeper	21/03/2018	1

If you have any questions or need further help, please contact the REC office at cgraham@sun.ac.za.

Sincerely,

Clarissa Graham

REC Coordinator: Research Ethics Committee: Human Research (Humanities)

National Health Research Ethics Committee (NHREC) registration number: REC-050411-032.
The Research Ethics Committee: Humanities complies with the SA National Health Act No.61 2003 as it pertains to health research. In addition, this committee abides by the ethical norms and principles for research established by the Declaration of Helsinki (2013) and the Department of Health Guidelines for Ethical Research: Principles Structures and Processes (2nd Ed.) 2015. Annually a number of projects may be selected randomly for an external audit.

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1.Conducting the Research. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.

2.Participant Enrollment. You may not recruit or enroll participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use.

3.Informed Consent. You are responsible for obtaining and documenting effective informed consent using **only** the REC-approved consent documents/process, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.

4.Continuing Review. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period.** Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit the progress report in a timely fashion to ensure a lapse in REC approval does not occur.** If REC approval of your research lapses, you must stop new participant enrollment, and contact the REC office immediately.

5.Amendments and Changes. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You **may not initiate** any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.

6.Adverse or Unanticipated Events. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouche within **five (5) days** of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the RECs requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch University Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.

7.Research Record Keeping. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC

8.Provision of Counselling or emergency support. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.

9.Final reports. When you have completed (no further participant enrollment, interactions or interventions) or stopped work on your research, you must submit a Final Report to the REC.

10.On-Site Evaluations, Inspections, or Audits. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

NELSON MANDELA
UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 2235
Charmain.Cilliers@mandela.ac.za

Ref: [H18-ART-MUS-EAP-001]

Contact person: Mrs U Spies

3 August 2018

Dear Dr Kohler

TITLE: **WHAT IS THE EXTENT OF KNOWLEDGE OF PERFORMANCE RELATED INJURIES AMONG BMUS VIOLIN STUDENTS IN SOUTH AFRICA, AND TO WHAT EXTENT IS THIS KNOWLEDGE TRANSLATED INTO PREVENTION AND HELP-SEEKING BEHAVIOUR/TREATMENT?**
REF NR: **MUS-2018-0254**

Your application for ethics approval to conduct research at Nelson Mandela University has been considered by the REC-H on the basis that the study has been duly vetted and approved by the University of Stellenbosch Ethics Committee.

Kindly use the following ethics reference number **H18-ART-MUS-EAP-001** together with your University's ethics clearance number in any correspondence with gatekeepers and participants at the University. Please inform the REC-H, of any changes that may arise during the execution of the study, particularly to the methodology.

It must be noted that the Nelson Mandela University assumes that the Research Ethics Committee responsible for providing the original ethics approval/clearance has undertaken both ethics and scientific review of the protocol according to the National Health Research Ethics Committee (2015) Guidelines, and assumes primary responsibility for oversight with regard to any ethical issues that may arise in the course of the study. The Nelson Mandela University would also wish to be provided with an executive summary of the findings from the research.

We wish you well with the project.

Yours sincerely

Prof C Cilliers
Chairperson: Research Ethics Committee (Human)

cc: Department of Research Capacity Development

NELSON MANDELA
UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 2235
Charmain.Cilliers@mandela.ac.za

Ref: [H18-ART-MUS-EAP-001]

Contact person: Mrs U Spies

1 October 2018

Dear Dr Martens

TITLE: **WHAT IS THE EXTENT OF KNOWLEDGE OF PERFORMANCE RELATED INJURIES AMONG BMUS VIOLIN STUDENTS IN SOUTH AFRICA, AND TO WHAT EXTENT IS THIS KNOWLEDGE TRANSLATED INTO PREVENTION AND HELP-SEEKING BEHAVIOUR/TREATMENT?**
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Yours sincerely

Prof C Cilliers
Chairperson: Research Ethics Committee (Human)

cc: Department of Research Capacity Development

Musculoskeletal complaints during the last twelve months among music academy and medical students specified by localization

		Music academy students (n = 83)	Medical students (n = 494)	Difference (p)
Hand	Right	14 (16.9%)	35 (7.1%)	P = 0.003*
	Left	7 (8.4%)	21 (4.3%)	P = 0.101*
Wrist	Right	14 (16.9%)	31 (6.3%)	P = 0.001*
	Left	13 (15.7%)	27 (5.5%)	P = 0.001*
Elbow	Right	2 (2.4%)	9 (1.8%)	P = 0.717*
	Left	6 (7.2%)	8 (1.6%)	P = 0.002*
Shoulder	Right	25 (30.1%)	42 (8.5%)	P < 0.001*
	Left	23 (27.7%)	32 (6.5%)	P < 0.001*
Neck		38 (45.8%)	135 (27.3%)	P = 0.001*
Upper back		16 (19.3%)	68 (13.8%)	P = 0.188*
Lower back		33 (39.8%)	191 (39%)	P = 0.860*
Knee	Right	5 (6.0%)	74 (15.0%)	P = 0.028*
	Left	5 (6.0%)	61 (12.3%)	P = 0.094*
Hip	Right	2 (2.4%)	13 (2.6%)	P = 0.906*
	Left	3 (3.6%)	22 (4.5%)	P = 0.728*
Ankle	Right	2 (2.4%)	29 (5.9%)	P = 0.196*
	Left	3 (3.6%)	32 (6.5%)	P = 0.312*
Foot	Right	5 (6.0%)	19 (3.8%)	P = 0.358*
	Left	2 (2.4%)	15 (3.0%)	P = 0.755*
Jaw		13 (15.7%)	31 (6.3%)	P = 0.003*
Mouth		9 (10.8%)	10 (2.0%)	P < 0.001*

* = Chi-squared Test.

Figure 1: Leaver *et al.* (2011) comparison between injuries in music students versus medical students